

# THE MONIST

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## ON THE NATURE OF ACQUAINTANCE.

### PRELIMINARY DESCRIPTION OF EXPERIENCE.

THE purpose of what follows is to advocate a certain analysis of the simplest and most pervading aspect of experience, namely what I call "acquaintance." It will be maintained that acquaintance is a dual relation between a subject and an object which need not have any community of nature. The subject is "mental," the object is not known to be mental except in introspection. The object may be in the present, in the past, or not in time at all; it may be a sensible particular, or a universal, or an abstract logical fact. All cognitive relations—attention, sensation, memory, imagination, believing, disbelieving, etc.—presuppose acquaintance.

This theory has to be defended against three rival theories: (1) the theory of Mach and James, according to which there is no distinctive relation such as "acquaintance," involved in all mental facts, but merely a different grouping of the same objects as those dealt with by non-psychological sciences; (2) the theory that the immediate object is mental, as well as the subject; (3) the theory that between subject and object there is a third entity, the "content," which is mental, and is that thought or state of mind by means of which the subject apprehends the object. The first of these rivals is the most interesting and the most formidable, and can only be met by a full and detailed

discussion, which will occupy a second essay. The other theories, along with my own, will be considered in a third essay, while the first essay will consist of an introductory survey of data. -

The word "experience," like most of the words expressing fundamental ideas in philosophy, has been imported into the technical vocabulary from the language of daily life, and it retains some of the grime of its outdoor existence in spite of some scrubbing and brushing by impatient philosophers. Originally, the "philosophy of experience" was opposed to the *a priori* philosophy, and "experience" was confined to what we learn through the senses. Gradually, however, its scope widened until it included everything of which we are in any way conscious, and became the watchword of an emaciated idealism imported from Germany. The word had, on the one hand, the reassuring associations of the "appeal to experience," which seemed to preclude the wilder vagaries of transcendental metaphysicians; while on the other hand it held, as it were in solution, the doctrine that nothing can happen except as the "experience" of some mind. Thus by the use of this one word the idealists cunningly forced upon their antagonists the odium of the *a priori* and the apparent necessity of maintaining the bare dogma of an unknowable reality, which must, it was thought, be either wholly arbitrary or not really unknowable.

In the revolt against idealism, the ambiguities of the word "experience" have been perceived, with the result that realists have more and more avoided the word. It is to be feared, however, that if the word is avoided the confusions of thought with which it has been associated may persist. It seems better to persevere in the attempt to analyze and clarify the somewhat vague and muddy ideas commonly called up by the word "experience," since it is not improbable that in this process we may come upon

something of fundamental importance to the theory of knowledge.

A certain difficulty as regards the use of words is unavoidable here, as in all philosophical inquiries. The meanings of common words are vague, fluctuating and ambiguous, like the shadow thrown by a flickering street-lamp on a windy night; yet in the nucleus of this uncertain patch of meaning, we may find some precise concept for which philosophy requires a name. If we choose a new technical term, the connection with ordinary thought is obscured and the clarifying of ordinary thought is retarded; but if we use the common word with a new precise significance, we may seem to run counter to usage, and we may confuse the reader's thoughts by irrelevant associations. It is impossible to lay down a rule for the avoidance of these opposite dangers; sometimes it will be well to introduce a new technical term, sometimes it will be better to polish the common word until it becomes suitable for technical purposes. In the case of "experience," the latter course seems preferable, since the actual process of polishing the word is instructive, and the confusions of thought which it covers cannot well be otherwise dispelled.

In seeking the central idea embodied in the word "experience," we shall at the same time be performing the analysis required for a definition of "mind" and "mental." Common sense divides human beings into souls and bodies, and Cartesian philosophy generalized this division by classifying everything that exists as either mind or matter. This division is so familiar, and of such respectable antiquity, that it has become part of our habits, and seems scarcely to embody a theory. Mind is what we know from within—thoughts and feelings and volitions—while matter is what is in space outside our minds. Nevertheless, almost all the great philosophers since Leibniz have challenged the dualism of mind and matter. Most of them, regarding

mind as something immediately given, have assimilated to it what appeared to be "matter," and have thus achieved the monism of the idealist. We may define an idealist as a man who believes that whatever exists may be called "mental," in the sense of having a certain character, known to us by introspection as belonging to our own minds. In recent times, however, this theory has been criticized from various points of view. On the one hand, men who admitted that we know by introspection things having the character we call "mental" have urged that we also know other things not having this character. On the other hand, William James and the American realists have urged that there is no specific character of "mental" things, but that the things which are called mental are identical with the things which are called physical, the difference being merely one of context and arrangement.

We have thus three opinions to consider. There are first those who deny that there is a character called "mental" which is revealed in introspection. These men may be called "neutral monists," because, while rejecting the division of the world into mind and matter, they do not say "all reality is mind," nor yet "all reality is matter." Next, there are "idealistic monists," who admit a character called "mental," and hold that everything has this character. Next, there are "dualists," who hold that there is such a character, but that there are things which do not possess it. In order to decide among these views, it is necessary to decide whether anything is meant by the word "mental"; and this inquiry brings us back to the meaning of "experience."

When we consider the world without the knowledge and the ignorance that are taught by philosophy, we seem to see that it contains a number of things and persons, and that some of the things are "experienced" by some of the persons. A man may experience different things at dif-



ferent times, and different men may experience different things at the same time. Some things, such as the inside of the earth or the other side of the moon, are never experienced by anybody, but are nevertheless believed to exist. The things which a man is said to experience are the things that are given in sensation, his own thoughts and feelings (at any rate so far as he is aware of them), and perhaps (though on this point common sense might hesitate) the facts which he comes to know by thinking. At any given moment, there are certain things of which a man is "aware," certain things which are "before his mind." Now although it is very difficult to define "awareness," it is not at all difficult to say that I am aware of such and such things. If I am asked, I can reply that I am aware of this, and that, and the other, and so on through a heterogeneous collection of objects. If I describe these objects, I may of course describe them wrongly; hence I cannot with certainty communicate to another what are the things of which I am aware. But if I speak to myself, and denote them by what may be called "proper names," rather than by descriptive words, I cannot be in error. So long as the names which I use really are names at the moment, i. e., are naming things to me, so long the things must be objects of which I am aware, since otherwise the words would be meaningless sounds, not names of things. There is thus at any given moment a certain assemblage of objects to which I could, if I chose, give proper names; these are the objects of my "awareness," the objects "before my mind," or the objects that are within my present "experience."

There is a certain unity, important to realize but hard to analyze, in "my present experience." If we assumed that "I" am the same at one time and at another, we might suppose that "my present experience" might be defined as all the experience which "I" have "now." But in fact

we shall find that "I" and "now," in the order of knowledge, must be defined in terms of "my present experience," rather than *vice versa*. Moreover, we cannot define "my present experience" as "all experience contemporaneous with *this*" (where *this* is some actual part of what I now experience), since that would ignore the possibility of experience other than mine. Nor can we define it as "all experience which I experience as contemporaneous with *this*," since that would exclude all that part of my experiencing of which I do not become introspectively conscious. We shall have to say, I think, that "being experienced together" is a relation between experienced things, which can itself be experienced, for example when we become aware of two things which we are seeing together, or of a thing seen and a thing heard simultaneously. Having come to know in this way what is meant by "being experienced together," we can define "my present contents of experience" as "everything experienced together with *this*," where *this* is any experienced thing selected by attention. We shall return to this topic on several subsequent occasions.

I do not propose as yet to attempt a logical analysis of "experience." For the present, I wish to consider its extent, its boundaries, its prolongation in time, and the reasons for regarding it as not all-embracing. These topics may be dealt with by discussing successively the following questions: (1) Are faint and peripheral sensations included in "experience"? (2) Are all or any of our present true beliefs included in present "experience"? (3) Do we now "experience" past things which we remember? (4) How do we come to know that the group of things now experienced is not all-embracing? (5) Why do we regard our present and past experiences as all parts of *one* experience, namely the experience which we call "ours"? (6) What leads us to believe that "our" total

experience is not all-embracing? Many of these questions will have to be discussed again more fully at a later stage; for the present, we are not discussing them on their own account, but in order to become familiar with the notion of experience.

1. Are faint and peripheral sensations included in "experience"? This question may be asked, not only with regard to sensations, but also with regard to faint wishes, dim thoughts, and whatever else is not in the focus of attention; but for illustrative purposes, the case of sensation, which is the simplest, may suffice. For the sake of definiteness, let us consider the field of vision. Normally, if we are attending to anything seen, it is to what is in the center of the field that we attend, but we can, by an effort of will, attend to what is in the margin. It is obvious that, when we do so, what we attend to is indubitably experienced. Thus the question we have to consider is whether *attention* constitutes experience, or whether things not attended to are also experienced. It seems we must admit things to which we do not attend, for attention is a selection among objects that are "before the mind," and therefore presupposes a larger field, constituted in some less exclusive manner, out of which attention chooses what it wants. In cases, however, where, in spite of the physical conditions which might be expected to produce a sensation, no sensation appears to exist, as for example when we fail to hear a faint sound which we should hear if our attention were called to it, it would seem that there is no corresponding "experience"; in such cases, in spite of the physical existence of the sound-stimulus, there seems to be sometimes no answering "mental" existent.

2. Our mental life is largely composed of beliefs, and of what we are pleased to call "knowledge" of "facts." When I speak of a "fact," I mean the kind of thing that is expressed by the phrase "that so-and-so is the case." A

"fact" in this sense is something different from an existing sensible thing; it is the kind of object towards which we have a *belief*, expressed in a proposition. The question I am asking now is not whether believing is experienced, for that I take to be obvious; the question is, whether the facts towards which beliefs are directed are ever experienced. It is obvious at once that most of the facts which we consider to be within our knowledge are not experienced. We do not experience that the earth goes round the sun, or that London has six million inhabitants, or that Napoleon was defeated at Waterloo. I think, however, that some facts are experienced, namely those which we see for ourselves, without relying either upon our own reasoning from previous facts, or upon the testimony of others. These "primitive" facts, which are known to us by an immediate insight as luminous and indubitable as that of sense, must, if I am not mistaken, be included in the original matter of experience. Their importance in the theory of knowledge is very great, and we shall have occasion to consider them very fully in the sequel.

3. Do we now experience past things which we remember? We cannot of course discuss this question adequately without a consideration of the psychology of memory. But in a brief preliminary way, something may be said to indicate an affirmative conclusion. In the first place, we must not confound true memory with present images of past things. I may call up now before my mind an image of a man I saw yesterday; the image is not in the past, and I certainly experience it now, but the image itself is not memory. The remembering refers to something known to be in the past, to what I saw yesterday, not to the image which I call up now. But even when the present image has been set aside as irrelevant, there still remains a distinction between what may be called "intellectual" memory and what may be called "sensational" memory. When I merely know

"that I saw Jones yesterday," this is intellectual memory; my knowledge is of one of these "primitive facts" which we considered in the preceding paragraph. But in the immediate memory of something which has just happened, the thing itself seems to remain in experience, in spite of the fact that it is known to be no longer present. How long this sort of memory may last, I do not profess to know; but it may certainly last long enough to make us conscious of a lapse of time since the thing remembered was present. Thus it would seem that in two different ways past things may form parts of present experience.

The conclusion that past things are experienced in memory may be reinforced by considering the difference between past and future. Through scientific prediction, we may come to know, with greater or less probability, many things about the future, but all these things are *inferred*: not one of them is known immediately. We do not even know immediately what we mean by the word "future": the future is essentially that period of time when the present will be past. "Present" and "past" are given in experience, and "future" is defined in terms of them. The difference between past and future, from the standpoint of theory of knowledge, consists just in the fact that the past is in part experienced now, while the future still lies wholly outside experience.

4. How do we come to know that the group of things now experienced is not all-embracing? This question arises naturally out of what has just been said concerning the future; for our belief that there will be a future is just one of those that take us beyond present experience. It is not, however, one of the most indubitable; we have no very good reason to feel sure that there will be a future, whereas some of the ways in which reality must transcend present experience seem as certain as any knowledge.

This question is one of great importance, since it intro-

duces us to the whole problem of how knowledge can transcend personal experience. For the present, however, we are not concerned with the *whole* of our individual experience, but only with the experience of a given moment. At first sight, it might seem as though the experience of each moment must be a prison for the knowledge of that moment, and as though its boundaries must be the boundaries of our present world. Every word that we now understand must have a meaning which falls within our present experience; we can never point to an object and say: "*This* lies outside my present experience." We cannot know any particular thing unless it is part of present experience; hence it might be inferred that we cannot know that there are particular things which lie outside present experience. To suppose that we can know this, it might be said, is to suppose that we can know what we do not know. On this ground, we may be urged to a modest agnosticism with regard to everything that lies outside our momentary consciousness. Such a view, it is true, is not usually advocated in this extreme form; but the principles of solipsism and of the older empirical philosophy would seem, if rigorously applied, to reduce the knowledge of each moment within the narrow area of that moment's experience.

To this theory there are two complementary replies. The one is empirical, and consists in pointing out that in fact we do know more than the theory supposes; the other is logical, and consists in pointing out a fallacy in the inference which the theory draws from the data. Let us begin with the empirical refutation.

One of the obvious empirical refutations is derived from the knowledge that we have forgotten something. When, for example, we try to recall a person's name, we may be perfectly certain that the name came into our experience in the past, but for all our efforts it will not come

into our present experience. Then again, in more abstract regions we know that there are facts which are not within our present experience; we may remember that there are 144 entries in the multiplication-table, without remembering them all individually; and we may know that there are an infinite number of facts in arithmetic, of which only a finite number are now present to our minds. In both the above cases, we have certainty, but in the one case the thing forgotten did once form part of our experience, while in the other, the fact not experienced is an abstract mathematical fact, not a particular thing existing in time. If we are willing to admit any of the beliefs of daily life, such as that there will be a future, we of course have a great extension of what exists without being experienced. We know by memory that hitherto we have constantly become aware, in sensation, of new particulars not experienced before, and that therefore throughout the past our experience has not been all-embracing. If, then, the present moment is not the last moment in the life of the universe, we must suppose that the future will contain things which we do not now experience. It is no answer to say that, since these things are future, they do not yet form part of the universe; they must, at all times, be included in any complete inventory of the universe, which must enumerate what is to come just as much as what is and what has been. For the above reasons, then, it is certain that the world contains some things not in my experience, and highly probable that it contains a vast number of such things.

It remains to show the logical possibility of the knowledge that there are things which we are not now experiencing. This depends upon the fact that we may know propositions of the form: "There are things having such-and-such a property," even when we do not know of any instance of such things. In the abstract mathematical world, it is very easy to find examples. For instance, we



know that there is no greatest prime number. But of all the prime numbers that we shall have ever thought of, there certainly is a greatest. Hence there are prime numbers greater than any that we shall have ever thought of. But in more concrete realms, the same is true: it is perfectly possible to know that there are things which I have known, but have now forgotten, although it is obviously impossible to give an instance of such things. To recur to our former example, I may perfectly remember that yesterday I knew the name of the lady I was introduced to, although to-day the name is lost to me. That I was told her name, is a fact which I know, and which implies that I knew a particular thing which I no longer know; I know that there was such a particular thing, but I do not know what particular thing it was. To pursue this topic farther would require an account of "knowledge by description," which belongs to a later stage. For the present, I am content to have pointed out that we know that there are things outside present experience and that such knowledge raises no logical difficulty.

5. Why do we regard our present and past experiences as all parts of one experience, namely the experience which we call "ours"? This question must be considered before we can advance to the further question, whether we can know that there are things which transcend the whole of "our" experience. But at our present stage we can only give it a brief preliminary consideration, such as will enable us to speak of one person's total experience with some realization of what we mean and of what are the difficulties involved.

It is obvious that *memory* is what makes us call past experiences "ours." I do not mean that only those experiences that we now remember are considered as ours, but that memory always makes the links in the chain connecting our present with our past. It is not, however,

memory *per se* that does this: it is memory of a certain sort. If we merely remember some external object, the experiencing is in the present, and there is not yet any reason to assume the past experience. It would be logically possible to remember an object which we had never experienced; indeed, it is by no means certain that this does not sometimes occur. We may hear a striking clock, for instance, and become aware that it has already struck several times before we noticed it. Perhaps, in this case, we have really experienced the earlier strokes as they occurred, but we cannot remember to have done so. Thus the case serves to illustrate an important difference, namely the difference between remembering an outside event and remembering our experiencing of the event. Normally, when we remember an event, we also remember our experiencing of it, but the two are different memories, as is shown by the case of the striking clock. The memory which prolongs our personality backwards in time is the memory of our experiencing, not merely of the things which we experienced. When we can remember experiencing something, we include the remembered experiencing with our present experiencing as part of one person's experience. Thus we are led to include also whatever experience we remembered at that earlier period, and so back, hypothetically, to earliest infancy. In the same hypothetical manner, we stretch our personality forward in time to all experiences which will remember our present experiences directly or indirectly.<sup>1</sup> By this extension of the present experience into a series of experiences linked by memory, we include within our own total experience all those particulars, spoken of under our last heading, which are known to have existed, though they do not form part of present

<sup>1</sup> In the language of the logic of relations, if *M* is the relation "remembering," *N* the sum of *M* and its converse, and *x* is any moment of experience, the total experience to which *x* belongs is all moments of experience which have to *x* the relation *N*\*. Cf. *Principia Mathematica*, \*90.

experience; and in case time should continue beyond the present moment, we include also those future experiences which will be related to our present as our present is related to our past.

6. What leads us to believe that "our" total experience is not all-embracing? This is the question of solipsism: What reason have we for believing that anything exists or has existed or will exist except what forms part of our total experience in the sense explained in the preceding paragraph?

The logical argument by which we showed that it is *possible* to know of the existence of things that are outside *present* experience applies, without change, to the existence of things that lie outside our *total* experience. Thus the only question we have to consider is whether, as a matter of empirical fact, we know anything which proves the existence of such things. In abstract logical and mathematical regions, it is easy, by means of the very examples which we used before, to *prove* that there are facts which do not form part of our total experience. It seems certain that we shall not think of more than a finite number of arithmetical facts in the course of our lives, and we know that the total number of arithmetical facts is infinite. If this example be thought inconclusive, on the ground that perhaps we survive death and become more interested in arithmetic hereafter, the following example will be found more stubborn. The number of functions of a real variable is infinitely greater than the number of moments of time. Therefore even if we spent all eternity thinking of a new function every instant, or of any finite or small infinite number of new functions every instant, there would still be an infinite number of functions which we should not have thought of, and therefore an infinite number of facts about them which would never enter our experience. It is

therefore certain that there are mathematical facts which do not enter into our total experience.

With regard to existing particulars,, no such cogent argument, so far as I know, can be produced. We naturally suppose that other people's bodies are inhabited by minds more or less like ours, which experience pleasures and pains, desires and aversions, of which we have no direct awareness. But although we naturally suppose this, and although no reason can be alleged for believing that our supposition is mistaken, yet it would seem also that there is no *conclusive* reason for believing it not mistaken. Exactly the same degree of doubt attaches to the inside of the earth, the other side of the moon, and the innumerable physical facts which we habitually assume without the warrant of direct experience. If there is good reason to believe in any of these things, it must be derived from induction and causality by a complicated process which we are not at present in a position to consider. For the present, let us assume as a working hypothesis the existence of other people and of unperceived physical things. From time to time we shall reconsider this hypothesis, and at the end we shall be in a position to sum up the evidence as to its truth. For the present, we must be content with the conclusions: (a) that there is no logical reason against it, (b) that in the logical world there certainly are facts which we do not experience, (c) that the common-sense assumption that there are particulars which we do not experience has been found thoroughly successful as a working hypothesis, and that there is no argument of any sort or kind against it.

The conclusion to which we have been led by the above discussion is that some of the things in the world, but not all, are collected together at any given moment of my conscious life into a group which may be called "my present experience"; that this group embraces things existing now, things that existed in the past, and abstract facts; also that in

my experiencing of a thing, something more than the mere thing is involved, and may be experienced in memory; that thus a total group of my experiences throughout time may be defined by means of memory, but that this group, like the momentary group, certainly does not contain all abstract facts, and appears not to contain all existent particulars, and in especial does not contain the experiencing which we believe to be associated with other people's bodies.

We have now to consider what is the analysis of "experiencing," *i. e.*, what is the bond which combines certain objects into the group forming a momentary experience. And here we must first consider the theory which we have called "neutral monism," due to William James; for the questions raised by this theory are so fundamental that until they are answered, in one way or in another, no further progress can be made.

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## WANG YANG MING, A CHINESE IDEALIST.<sup>1</sup>

TO the philosophic basis of her civilization, more than to any other single factor, is due the survival of China's social institutions and the preservation of her national integrity. The influence of Confucius and Mencius upon Chinese life and thought has been more penetrating and profound than the impress of Greek philosophy upon European life and culture. As in the development of philosophic thought in India interpretation always harks back to the Rig Veda for its authority, so for the philosophic expositions of Chinese philosophers the criterion of orthodoxy is in accord with the Four Books and the Five Classics. This, however, does not exclude the possibility of spirited discussion with reference to the precise connotation of certain classic expressions and the subsequent formation of systems varying as widely as realism and idealism. The object of this essay is to familiarize the reader with one of these systems, the most important one that has appeared in China within the modern period,—that of the philosopher Wang Yang Ming.

The date of Wang Yang Ming's life is approximately 1472-1528. As compared with contemporary European history, he lived in the period of the great maritime discoveries and at the beginning of the Reformation. He was fearlessly propounding his view in China shortly before

<sup>1</sup> Extracts from a paper read before the Royal Asiatic Society, Shanghai, published in this form with permission of the Council. It constitutes a part of the result of two years' research in the Chinese text of the philosophy and letters of Wang Yang Ming.

Giordano Bruno, after a life of restless wandering in search of truth, suffered martyrdom for his philosophic exposition of the universe, and about a century previous to Hobbes, Descartes and Spinoza. The spirit which actuated him was closely akin to that of the Reformation. Thoroughly dissatisfied with what seemed to him useless striving for form and style in literary composition and with the vain discussions of scholars, who ignored the great moral, religious and political issues of his day and gave an incorrect interpretation of the fundamental principles of human life and the universe, he strove to bring the leaders of his people back to the original path of duty outlined in the Four Books and the Five Classics.

At the age of thirty-seven, while serving as a disgraced official, because of the enmity of the eunuch Liu Tsing, in the government despatch service in the province of Kweichow, he received his great enlightenment. His biographer describes Lungch'ang where he was stationed as a resort of venomous snakes and poisonous worms, inhabited by babbling barbarians with whom he could not converse. The situation was extremely critical. He feared that at any moment a decree from the capital might order his death. Moreover, his followers all fell ill. Nothing daunted, he chopped wood himself, carried water, and made soft-boiled rice for them, cheering them with songs and stories of home. Also, in view of his own precarious position, he had a sarcophagus made. In the midst of all these difficulties, the chief subject of his meditation was, "What additional methods would a sage adopt under similar circumstances?" At midnight while on his couch, he suddenly realized what the sage meant by "investigating things for the sake of extending knowledge to the utmost." Overjoyed, he unconsciously called out and, getting up, paced the room. "I was wrong," he said, "in looking for fundamental principles in things and affairs. My nature is



sufficient." From that time he was a faithful defender of idealism against the realism of the philosopher Chu, whose commentaries on the classics were considered as an authority at that time.

The philosophy of Wang Yang Ming, the teacher of Yang Ming grotto, is to-day held in high esteem by the Japanese as an ideal statement of the fundamental principles of life and the universe, and has been a profound factor in their moral development during the last hundred years. In China a tide of rising popularity is rapidly bringing it out of obscurity into the forefront. Not as a closet-philosopher but as a military hero, patriot, and reformer-statesman, his ideal was to bring the scholars of his day back to the true learning of the sages. Educated men of his day spent their time in perfecting library style, their one ambition being success in examinations and a high literary degree, that thereby they might gain emolument and fame; but he considered such procedure ethically unsound. For him the greatest thing was not study to become a *Chinshih*, but study to become a sage.<sup>2</sup> His was an attitude of mind that dwelt upon great moral values, and found fullness of life and moral integrity of greater worth than fame and gain. One day while feasting with several of his disciples, he took occasion to lay bare the futility of his day. "We eat and drink," he said, "only in order to nourish the body. The food which has been eaten must be digested. If it collects in the stomach it causes dyspepsia, and how can it then become muscle? Later scholars study extensively and know much, but what they read and know remains undigested. They all have dyspepsia."<sup>3</sup>

<sup>2</sup> *Chinshih* under the old system of literary examinations was a degree corresponding approximately to the European "Doctor of Philosophy." Once attained, honor, influence and position were assured.

<sup>3</sup> The Philosophy of Wang Yang Ming, Book 2, *Yü Lu*, p. 6. All references to the Philosophy of Wang Yang Ming in this paper are to the Chinese

Confusion and display seemed to him to be prominently characteristic of contemporary learning. Failing to function properly in the life process, it wrought havoc wherever it prevailed. He compared the students of his day to a theatre where a hundred different acts are presented. "The players cheer, jest, hop and skip. They emulate one another in cleverness and ingenuity. They laugh in the play and strive for the palm of beauty. On all sides they emulate one another. The people look toward the front and gaze toward the rear, but cannot see it all. Their ears and their eyes are confused; their mental and physical energy is disturbed. Day and night they spend in amusement. They are steeped in it and rest in it as though they were insane. They do not even know what has become of their family property. Under the influence of such scholars, princes and kings are confused and confounded and all their lives devote themselves to vain, useless literary style. They do not know what they say. The learning of the sages is daily left more in the distance and becomes more obscured, while practices are directed toward acquiring honor and gain. The farther they go the more they fall into error. Though some of them have been deceived by Buddhism and Taoism, yet even the sayings of Gautama and Lao Tze are unable to influence permanently the mind that is devoted to honor and gain."<sup>4</sup>

In order to appreciate Wang Yang Ming's point of view, it is necessary to keep this steadily in mind, for his interest was that of a reformer and thus largely ethical. He attempted to place learning and conduct upon a firm basis. The glamour of a superficial philosophic foundation had no fascination for a man of his practical bent of mind. He sought bed-rock; he wished to find the very source of life and the universe. After having sought vainly in Buddhism of his work,—the only one available. While they are not of general interest, they will serve to locate the references for such as read Chinese.

<sup>4</sup> The Philosophy of Wang Yang Ming, Book 3, p. 71.

dhism and Taoism for relief; after having tried the philosopher Chu's instructions to search for principles in external things, but without success; at last in the middle of the night while among the barbarians in far Kwei Chow he came to a state of realization. It was as though the fog had suddenly cleared away. "My nature is sufficient," he said. Upon this foundation the whole structure of his ontology, cosmology, and ethics rests.

What does Wang Yang Ming mean when he speaks of nature? He discusses it in a somewhat fragmentary manner a number of times both in his discourses and in his letters, so that by bringing together the principal ideas involved we are able to get an approximate idea of what his conception includes. Luh Ch'en, one of his disciples, asked him the question, "Are the feelings of commiseration, shame, dislike, modesty, complaisance, approval, and disapproval to be considered nature manifesting virtue?" To this Wang Yang Ming replied: "There is only one nature and no other. Referring to its form and substance, it is Heaven; considered as ruler or lord, it is Shang-ti (God); viewed as functioning, it is fate; as given to men, it is disposition; and as controlling the person, it is mind; manifested by mind, it is called filial piety when it meets parents, and loyalty when it meets the prince. Proceeding from this on, it is inexhaustible, but it is all one nature. Man should use his energy on his nature. If he is able to understand the connotation of the word 'nature,' he will be able to distinguish ten thousand principles."<sup>5</sup> A careful perusal of this makes it evident that this subtle something which Wang designates "nature" is so profound, so rich, so all-inclusive, that viewed as a whole the absolutist would probably greet it as his old friend the absolute, even though it be in Chinese garb. At another time Wang Yang Ming said: "Heaven and earth are one structure with me; spirits

<sup>5</sup> *Ibid.*, Book 1, p. 26.

and gods are in one all-pervading unity with me."<sup>6</sup> It is, under such circumstances, reasonable to suppose that the discussions of nature by men of the past would be various. "There were those," he said, "that discussed it from the point of its underlying substance; there were those that based their discussions on its manifestations; there were those that proceeded from its source; there were those that proceeded from the point of its defects and corruptions. Taking it all together, they all referred to this one nature, but there were degrees of depth in what they saw."<sup>7</sup>

Thus far, however, the discussion emphasizes the profundity, abstruseness, comprehensiveness, and wealth of manifestation of nature in a very general way, but fails to point out accurately its fundamental character. Intelligence appears to be of prime importance. But is it really so, or is it perhaps only a by-product, while mechanism is basal? Wang does not fail to elucidate this point. "There is one nature," he asserts, "and that is all. Charity, righteousness, propriety, and wisdom are *ab initio* characteristic of it; quick apprehension, clear discrimination, far-reaching intelligence, and all-embracing knowledge are native to it. Pleasure, anger, sorrow, and joy are the feelings of this nature."<sup>8</sup> Of its qualities of character, benevolence, which the sages have designated as the highest virtue, is the principle of continuous creating and growth. This principle is boundless in extent and everywhere present, but in its process and manifestation it advances gradually.<sup>9</sup>

However, it was in men's mind that he primarily was interested. "My own nature is sufficient,"<sup>10</sup> he said when he came to a state of realization. If nature at large be designated as the macrocosm, then human nature is the micro-

<sup>6</sup> *Ibid.*, Book 2, p. 26.

<sup>7</sup> *Ibid.*, Book 2, p. 31.

<sup>8</sup> *Ibid.*, Book 3, p. 20.

<sup>9</sup> *Ibid.*, Book 1, p. 37.

<sup>10</sup> *Ibid.*, Biography, p. 8.

cosm, and for him human nature was the human mind. He was taking recreation at Nan Ch'en when one of his friends pointed to the flowers and trees on a cliff and said, "You say that there is nothing under heaven outside the mind. What relation to my mind have these flowers and trees on the high mountain, which blossom and drop of themselves?" Wang replied: "When you cease regarding these flowers, they become quiet with your mind. When you see them, their colors at once become clear. From this you can know that these flowers are not external to your mind."<sup>11</sup> This is undisguised idealism in which the microcosm creates as truly as the macrocosm. In the great all-pervading unity the most differentiated, highly specialized portion is the human mind. It manifests the only creative activity that men can really know. It is self-sufficient and embraces the universe. He said again and again that the mind of man is *ab initio* law, that it is the embodiment of the principles of Heaven. Thus its very essence is natural law, though not in any partial, superficial sense. There are no other principles operative any where, for the mind is so all-embracing that it has no within and without.<sup>12</sup>

Chiu Ch'uan had great difficulty in comprehending Wang's explanation of things, for from his common-sense point of view things were external. He questioned his teacher's position that a thing is identical with the presence of an idea. "Since things are external," he said, "how can they be one with the person, the mind, purpose and knowledge?" To which the teacher replied: "The ears, eyes, mouth, nose and four members constitute the person, or body; yet without the mind how can the person see, hear, speak, or move? On the other hand, if the mind wishes to see, hear, speak, or move, it is unable to do so without the use of ears, eyes, mouth, nose, and the four

<sup>11</sup> *Ibid.*, Book, 2, p. 17.

<sup>12</sup> *Ibid.*, Book 2, p. 4.

members. From this it follows that if there is no mind, there is no person, or body, and that if there is no person, or body, there is no mind. If one refers only to the place it occupies, it is called person, or body; if one refers to the matter of control, it is called mind; if one refers to the activities of the mind, it is called purpose; if one refers to the intelligence of the purpose, it is called understanding; if one refers to the relations (implications) of the purpose, it is called things."<sup>13</sup> From this it is evident that from Wang Yang Ming's point of view the volitional activity of the mind is true creative activity. In case the purpose is used with reference to the flowers growing on the side of the mountain precipice, then these flowers are a thing. Take away the purpose and *ipso facto* the flowers are no more. "When the purpose is used with reference to serving one's parents, then serving one's parents must be considered a thing. If it is used with reference to governing the people, then governing the people must be considered a thing. When the purpose is used in study, then study must be considered a thing; and when it is used in hearing litigation then this is a thing. Wherever the purpose is applied, there some definite thing is present. If there is a particular purpose, there is a particular thing present corresponding to it; and without this particular purpose the particular thing is lacking. Is not then," Wang asked, "a thing identical with the functioning of the purpose?"<sup>14</sup>

These, in brief, are the fundamental principles of his metaphysics. That he considered volitional activity as basal is evident, but will be more so as epistemological and ethical phases of his system are discussed.

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For Wang Yang Ming the epistemological problem centered primarily about the question of investigating things for the avowed purpose of extending knowledge to

<sup>13</sup> *Ibid.*, Book 2, p. 2.

<sup>14</sup> *Ibid.*, Book 3, p. 58.

the utmost. Readers of the Chinese classics will recognize that this idea is mentioned in the Great Learning in the introductory text of Confucius. The difficulty lies not so much in the words themselves, for these seem clear enough, but in their correct interpretation. Like the oracles of Apollo at Delphi, a closer examination shows them to have an obscure, ingeniously ambiguous connotation. The question is: What does "investigation of things for the purpose of extending knowledge to the utmost" imply?

The philosopher Chu in his commentary on the fifth chapter of the Great Learning had said: "If we wish to carry our knowledge to the utmost we must investigate the principles of all things with which we come into contact."<sup>15</sup> Since one of the necessary qualifications of a sage is just this, that he have extended his knowledge to the utmost, it was but natural that Wang, whose one ambition was to become a sage, should attempt to carry this out into practice. He chose as his point of departure the more manifest interpretation of the philosopher Chu, and tried to follow out the instructions therein given. He and his friend Ch'ien discussed the possibility of investigating everything under heaven. Pointing to a bamboo in front of the pavilion, he told Ch'ien to investigate it. Both day and night Ch'ien worked at the task and after three days he was physically and mentally so exhausted that he took sick. Wang feared that this was solely due to lack of strength and energy, and himself undertook to carry on the investigation. Though he worked day and night he, too, was unable to understand the principles of the bamboo, and after seven days became ill from over-exertion. Discouraged, both Ch'ien and he gave up. "We can become neither sages nor virtuous men," they said, "for we lack the great strength required to carry on the investigation of things."<sup>16</sup>

<sup>15</sup> The Great Learning, Chap. 5.

<sup>16</sup> The Philosophy of Wang Yang Ming, Book 2, p. 22.



Not until his enlightenment while at Lungch'ang did he realize the futility of attempting thus to investigate the things under heaven. There had been sages in the past, this he knew. From his own experience he saw that a thorough investigation of so commonplace a thing as a bamboo was not possible. How much less the investigation of all things! From now on his task was that of expounding a better way.

Relief was found in adopting the view that knowledge can be extended to the utmost only by a thorough devotion to nature. If the principles of things and affairs are to be exhaustively investigated, and thereby knowledge completed, it must be as a result of understanding and developing the mind. Not things without, but mind itself, offers the solution. The point of departure is the intuitive faculty or, in other words, nature itself. "This seeking for fundamental principles in things and affairs," said he, "is exemplified in seeking the principle of filial piety in one's parents. In case a person seeks the principle of filial piety in the parents, is it then in his own mind or is it in the person of the parents? In case it is in the person of the parents, is it then true that after the parents are dead, the mind lacks the principle of filial piety? If one sees a child fall into a well, there must be commiseration. Is this principle of commiseration in the child, or is it found in the intuitive faculty of the mind? Whether the individual is unable to follow the child and rescue it from the well or seizes it with his hand and saves it, this principle is involved. Is it then in the person of the child or is it rather in the intuitive faculty of the mind?"<sup>17</sup> At another time he discussed this matter with Liang Jih Fu. "Tell me," he said, "what is meant by a thorough investigation of the principles of events and things?" Liang replied: "It would imply that in caring for one's parents one must thoroughly investigate

<sup>17</sup> *Ibid.*, Book, 3, p. 54.

the principles of filial piety, or in serving one's prince one must thoroughly investigate the principles of loyalty." Thereupon Wang said: "Are the principles of loyalty and filial piety to be investigated on the bodies of the prince and parents, or in one's own mind? If they are to be investigated in the mind, that would imply a thorough investigation of the principles of the mind."<sup>18</sup>

The problem of knowledge must be solved by depending upon the intuitive faculty and developing it. The development of knowledge refers to the development of intuitive knowledge, for the field of knowledge and the field of intuitive knowledge are conterminous. In so far as the intuitive faculty remains undeveloped, knowledge is undeveloped; and in so far as it is developed, the individual has knowledge of things and affairs. Intuitive knowledge does not come from seeing and hearing, though sense-perception is itself a function of the intuitive faculty. Apart from it there is no knowledge.<sup>19</sup> It knows without cogitation, and is able to act without learning.<sup>20</sup> Wang praises it as being absolutely perfect. When Chiu Ch'uan asked him about the method of extending knowledge, he said: "The intuitive faculty is your standard. If your thoughts are right it is aware of it, and if they are wrong it also knows it. You must not blind it nor impose upon it, but must truly follow its lead. Whatever is good should be cherished; whatever is evil should be discarded. What confidence and joy there is in this! This is the true secret of the investigation of things and the real method of extending knowledge to the utmost. If you do not depend upon these true secrets, how will you engage in an investigation of things? I, too, have appreciated only in the past few years that it is to be thus explained. At first I doubted that a simple obedience to the intuitive faculty

<sup>18</sup> *Ibid.*, Book 1, p. 49.

<sup>19</sup> *Ibid.*, Book 3, p. 42.

<sup>20</sup> *Ibid.*, Book 3, p. 46.

would be sufficient. When I had very carefully examined it, I found that it has no deficiency whatsoever."<sup>21</sup>

The ethics of Wang Yang Ming's system is also firmly lodged in his exposition of the intuitive faculty, which he considers is the point of clearness that natural law attains in its moral aspects. For this reason intuitive knowledge of good is to be identified with moral principles. The intuitive faculty is tranquil; it is the equilibrium in which there is no stirring of the feelings. He who would understand the path of duty must exercise this faculty, for it alone marks clearly the path of duty. He who would choose the right and expel the evil must make use of it, for there is nothing in the categories of right and wrong that it does not naturally know. The highest good is simply the development of the intuitive faculty to the utmost. The finished product is a sage. "All-embracing and vast, he is like heaven; deep and active like a fountain, he is like the abyss."<sup>22</sup> Serving his fellow-men and regulating his passion-nature, he is actuated by the desire to be a man who in his eager and unceasing pursuit of knowledge forgets his food. Forgetting his sorrow in the joy of the attainment of knowledge, he is never distressed. With reference to the principles of Heaven he is both omniscient and omnipotent.<sup>23</sup> Completely dominated by moral principles and wholly unhampered by passion, his integrity and moral worth are of the quality of the finest gold. The capacity may vary from man to man, but the quality is always of the highest and purest type.<sup>24</sup>

A deaf and dumb man, Yang Mao by name, visited Wang Yang Ming, who conferred with him by means of writing. The ensuing conversation, which may well serve

<sup>21</sup> *Ibid.*, Book 2, pp. 4 and 5.

<sup>22</sup> Doctrine of the Mean, Chap. 31, § 3.

<sup>23</sup> Philosophy of Wang Yang Ming, Book 2, p. 8.

<sup>24</sup> *Ibid.*, Book 1, pp. 40f.

to exemplify his method of dealing with the ethical problem, was as follows:<sup>28</sup>

Wang Yang Ming said: "You are unable to speak or discuss either that which is right or that which is wrong. You cannot hear that which is right nor that which is wrong. Is your mind still able to distinguish right from wrong?"

Mao replied: "I know right and wrong."

"In that case," said Wang, "though your mouth is different from that of other men, and your ears are not like other men's ears, yet your mind is like that of other men."

Mao replied in the affirmative by nodding his head and thanking with his hands.

"In man," wrote Wang, "the mind alone is important. If it cherishes the principles of Heaven, it is the mind of sages and virtuous men. In that case, though the mouth cannot speak and the ears cannot hear, it is only sages and virtue that cannot speak or hear. If on the other hand the mind does not cherish the principles of Heaven, it is the mind of birds and animals. Though under such circumstances there were the power of speech and audition, yet it would be merely an instance of a speaking and hearing bird or animal."

Mao struck his breast and pointed toward heaven.

Wang said: "Toward your parents you should exhaust the filial piety of your mind; toward your elder brother, its respectfulness; toward your village clan, your neighbors, your kindred and your relatives, its complaisance, harmony, respectfulness, and docility. When you see others prosperous, you should not covet their wealth and advantage. Within yourself you should practice that which is right and not that which is wrong. It is really not necessary that you should hear it when others say that you are

<sup>28</sup> *Ibid.*, Book 4, pp. 83 and 84.

right, nor do you need to hear it when they speak of your mistakes."

Mao nodded his head and bowed in thanks.

"Since you are unable to discuss or hear right or wrong, you are saved the necessity of making distinctions between a great deal of idle, useless right and wrong. The discussion of truth and error begets truth and error and brings forth trouble and vexation. By hearing good and evil one adds to one's right and wrong and to one's troubles. Since you cannot speak or hear, you are spared a good deal of useless good and evil, as well as much trouble and vexation. You are much more cheerful, happy, and self-possessed than others."

Mao struck his breast, pointed toward heaven, and replaced his feet on the ground.

Thereupon Wang said: "My instruction to you to-day is that it is only necessary to act in accordance with your mind and not necessary to speak; that it is only necessary that you comply with your mind and not necessary to hear."

Mao prostrated himself, saluted, and departed.

In its practical aspects, Wang's ethical system places special emphasis upon action as the *sine qua non* of moral progress. Knowledge and action, theory and practice, are so interrelated that the former does not exist without the latter. Nature can be developed only as the individual directly applies what he knows. In case he fails to act, the knowledge that he supposes himself to have has not really been acquired. Here Wang is not far from pragmatism, which urges that the truth of an idea consists in its verifiability. As Paul S. Reinsch has stated in *Intellectual and Political Currents in the Far East* (page 138), this phase of his philosophy has doubtless had a profound influence upon students in Japan and China.

The absolute moral perfection of the intuitive faculty presented a serious problem to some of Wang's disciples.

That the main divisions of the doctrine and the general direction of the path of duty could be readily understood in this way seemed clear to them; but with regard to changeable sections and paragraphs and the details of conduct under changing circumstances, they felt considerable apprehension. Is the intuitive faculty really able to mediate reliable knowledge in such cases, or is it necessary for a person to seek earnestly for what is right and wrong in things themselves? Is knowledge of right and wrong innate, or is it acquired from experience? In a letter to his teacher, Ku Tang Ch'iao urges that when one reaches the facts that Shun married without informing his parents,<sup>26</sup> that Wu put troops into the field before he buried his father, that the son endures the small stick but evades the large one, that he cuts flesh from his thigh to feed his ill parent, that he erects a straw hut beside the grave of his parent, or any similar thing, then the knowledge mediated by the intuitive faculty is inadequate and a person must depend upon his experience.<sup>27</sup> Wang considered this position incorrect, for he felt that the intuitive faculty has the same relation to the details of right and wrong and to changing circumstances as compasses and squares have to squares and circles, and measures to length and breadth. "The changes in circumstances relative to details," he said, "cannot be determined beforehand, just as the size of the square or the circle, and length and breadth, cannot be perfectly estimated. But when compasses and squares have been set, there can be no deception about the size of the square or the circle, and when rule and measure have been fixed there can be no deception about length or shortness. When the intuitive faculty has been completely developed there can be no deception regarding its application to changing details. As for Shun's marrying without tell-

<sup>26</sup> Shun and Wu were two famous emperors of ancient China.

<sup>27</sup> Philosophy of Wang Yang Ming, Book 3, p. 61.

ing his parents, was there any one previous to his time who served as an example of such a deed? In what historical and mythological document did he find a precedent, or of what individual did he make inquiry? Or did he rather make use of the intuitive faculty to consider what should be done, and there being no other way act thus?"<sup>28</sup> What is true in this instance Wang taught as true in all others. From his point of view the intuitive faculty is quite competent to grapple with any moral problem whatsoever.

Last, but not least, is the problem of evil. No system of philosophy is complete without having attempted a solution for this perennial problem, and more than one system has suffered shipwreck in the attempt. Wang also was unable to disregard it. Hsieh K'an, one of his favorite disciples, was pulling grass out from among the flowers. "How difficult it is," he said, "to cultivate the good in Heaven and on earth, and how hard it is to get rid of the evil!" Wang said, "You should neither cultivate the good nor expel the evil." A little later he continued, "This way of viewing good and evil has its source in the body and thus is open to mistakes." As Hsieh K'an was not able to comprehend, he added: "The purpose of Heaven and earth in bringing forth is even as in the instance of flowers and grass. In what does it distinguish between good and evil? If you, my disciple, take pleasure in seeing the flowers, then you will consider flowers good and grass bad. If you wish to use the grass you will, in turn, consider the grass good." Hsieh K'an replied, "In that case there is neither good nor evil, is there?" Wang answered, "The tranquility of the principles of Heaven is a state in which there is neither good nor evil, while the stirring of the passion-nature is a state in which there is both good and evil."<sup>29</sup>

For him there was only one real evil, and that consisted

<sup>28</sup> *Ibid.*, Book 3, pp. 61f.

<sup>29</sup> *Ibid.*, Book 1, pp. 42f.



in exceeding or failing to realize nature. All other distinctions between good and evil seemed to him to savor of arbitrariness and superficiality. The mind is by nature clear and bright and the intuitive faculty, if given free play, will develop to the utmost. Selfish desire and ceremoniousness are things that obscure it and obstruct its smooth functioning. If the mind in its natural condition is like a clear bright mirror, then selfish desires and deeds are the dust and spots that darken it and hinder it from reflecting clearly. The mind of the sage allows no obscuration to take place, but the mind of the ordinary man is subject to all the evils that inhere in the selfish striving for gain and fame.<sup>30</sup>

As a remedy for evil he advocated that all obscuration be removed from the mind and every obstruction be taken away, so that it can function normally. To this end the determination must be fixed and the purpose made sincere. The mind must continually cherish the principles of Heaven, for so long as it does this it is proceeding along the line of nature. If the individual fails at the point of making and keeping his purpose sincere, no amount of striving to understand so-called external things will keep the evil from sprouting, for this striving is itself a token of selfishness. By removing all obscuration and every obstruction of selfishness, passion, pride and ceremoniousness from the intuitive faculty, it is given perfect freedom to develop naturally and normally. The teacher spoke to his disciples saying, "Sirs, in your task of developing the mind, you must not in the least hinder or force the development. The student cannot leap over into the principles of the sage. Rising, falling, advancing, receding, are naturally the order of the task."<sup>31</sup> However, in all this the determi-

<sup>30</sup> *Ibid.*, Book 4, p. 5.

<sup>31</sup> *Ibid.*, Book 2, p. 12.

nation must be fixed and the purpose sincere.<sup>32</sup> There must be absolute devotion to the intuitive faculty and unfailing loyalty to nature. "Without sincerity there can be nothing."<sup>33</sup>

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<sup>32</sup> *Ibid.*, Book 1, p. 56f.

<sup>33</sup> Doctrine of the Mean, Chap. 25, § 2.

## CHRISTIAN ELEMENTS IN LATER KRISHNAISM AND IN OTHER HINDUISTIC SECTS.\*

### KRISHNA AND CHRIST.

WE are treading on solid ground when, in the question of Christian contributions, we turn to that particular phase of Krishnaism which we meet in the literature of the Purânas, of works similar to the Purânas and of writings intrinsically connected with the Purânas.

Of all Indian religions Krishnaism (as Hopkins correctly observes)<sup>1</sup> was by its nature most easily accessible to Christian influences. Buddhism, at least in its original form, was a religion which recognized neither God nor soul; Shivaism places greatest weight upon rites and self-mortification, whereas Krishnaism in its popular form is a religion of joy; it rejects bloody sacrifice and preaches love. To these fundamental features of Indian religions which Hopkins has emphasized, we might add that Jainism also, which is so closely allied to Buddhism and which has continued in India to the present day, possesses no similarity to Christianity in its religious character. On the other hand there exists between Christianity and Krishnaism an intrinsic relationship which explains the susceptibility of the latter to Christian influences. To this intrinsic

\* Authorized translation from the German manuscript by Lydia G. Robinson. In the bibliographical references the following abbreviations will be observed: ERE, *Encyclopædia of Religion and Ethics*; IA, *Indian Antiquary*; JAOS, *Journal of the American Oriental Society*; JRAS, *Journal of the Royal Asiatic Society*.

<sup>1</sup> *India Old and New*, 162.

relationship may be added an external reason to which attention has often been called, namely, that the similarity of the names Christ and Krishna, which is often in evidence to-day in the religious conversations and writings of Indians, has certainly facilitated the adoption of Christian features. In some localities of India the word Krishna is pronounced Krishta.<sup>2</sup>

#### THE GOD'S BIRTHDAY.

I shall begin with an element of the worship which in all probability is the oldest Christian possession in Krishnaism and moreover renders it possible to recognize Christian influence with such distinctness that it supplies an appropriate basis for the investigation of the other effects of Christianity upon Hinduism. This element is the celebration of Krishna's birthday concerning which we have the learned and circumstantial—I might say the too detailed—treatise of A. Weber,<sup>3</sup> the main results of which are unassailable, although in some particulars it is not quite correct.

We have seen above<sup>4</sup> that the conception of Krishna as a divine child which has contributed so much to the spread of Krishnaism all over India is autochthonous. The celebration of Krishna's birthday, however, is an imitation of the Christian festival. Weber<sup>5</sup> describes twelve texts, which he dated from the thirteenth century on, in which the Janmāstamī (Krishna's birthday), or a variant of it bearing the name Jayanti, is treated in more or less detail;

<sup>2</sup>Grierson, JRAS, 1907, 316.

<sup>3</sup>On the Krishnajanmāstamī (Krishnas Geburtsfest) in the *Abhandlungen der K. Akademie der Wiss. zu Berlin*, 1867, 217ff. The earlier literature on the question of the connection between Christian and Krishnaistic legends which has been so much discussed since the middle of the eighteenth century is mentioned on pages 3-10ff. Cf. also Hopkins, *Religions of India*, 430ff.; *India Old and New*, 162ff.

<sup>4</sup>See "Christian Elements in the Mahābhārata," *The Monist*, July, 1913, pp. 343ff.

<sup>5</sup>*Op. cit.*, 218ff.

and adds, what is more important historically, a list of the Purânas which mention the festival and of the Purâna passages quoted.<sup>6</sup> From this we learn that almost all the Purânas contain such mention<sup>7</sup> and that most of all the Bhavishya and Bhavishyottara-Purâna come into consideration,<sup>8</sup> according to which Krishna himself is said to have established the festival as soon as he had slain Kamsa, and indeed in the midst of universal jubilation for all castes, even for the Shûdras.<sup>9</sup>

When from the quotations out of the Purânas, Weber<sup>10</sup> explains the Krishna festival to be positively authenticated for about the eleventh century, this late date rests upon the low estimate of the age of the Purânas which was generally prevalent among Sanskritists at the time when Weber's treatise appeared (1867) and still later. Nevertheless Weber at once adds this sentence: "*The unanimity of so many works* of this kind in the meantime may lead us considerably farther upwards, since such a *universal* recognition of the festival indeed demands the conclusion that at the time of their composition it was generally accepted, whereupon *eo ipso*, the farther assumption naturally follows that its *adoption* or *introduction* goes back to a *still earlier* time." This "earlier time" he seeks to determine more exactly by succeeding passages, always under the spell of his conviction that Christian influences had penetrated to India from Alexandria in Egypt.<sup>11</sup>

\* *Ibid.*, 221ff., especially 239. The quotations from the Smriti are rather unimportant since these versified texts are "modern compilations of secondary significance" in spite of the ancient names Parâshara, Paithinasi, Bhṛigu, Vasishtha, Vishnu, Vyâsa. See Jolly, *Recht und Sitte*, 24.

<sup>7</sup> Strangely enough not the Bhâgavata-Purâna in spite of its sectarian Krishna character which is especially distinct in the tenth book. To be sure it describes in detail the time of Krishna's birth (10, 3, 1-8) but says nothing of the festival. This must certainly have a definite reason which according to Weber (page 241) may be sought in the fact that "in the Bhâg. Pur. we have the modern interpretation of the worship of Krishna which is occupied mainly with the *love affairs* of Krishna and in which the *mother* of God withdraws more and more into the background."

\* Weber, 242ff.

\* *Ibid.*, 248.

<sup>10</sup> *Ibid.*, p. 240.

<sup>11</sup> Compare *The Monist*, July, 1913, p. 324.

Weber starts from the fact that Christ's birthday has been celebrated in the Christian church since the middle of the fourth century and that in Alexandria a festival of the birth of Christ existed in connection with that of his baptism on January 6, which "was supplanted shortly before the year 431 by an independent and exclusive celebration of the Christmas festival on December 25."<sup>12</sup> Now because the naming of Krishna forms an integral part of the celebration of his birth, it seems to Weber extremely obvious that the Hindus adopted the festival in the period "during which that peculiarly Egyptian custom, to celebrate the birth of Christ *at the same time* as his *baptism* on January 6, prevailed, i. e., in the time between the *second* half of the *fourth century* and the *year 431* when the celebration of the *birth alone* on December 25 replaced it."

It is clear that this conjecture of Weber's and the reason for it stand upon a weak foundation. But J. Kennedy is mistaken when he says<sup>13</sup> that "Weber's chief arguments are drawn from the history of the legends regarding the Virgin and the representations of the *Madonna lactans*; on this basis he assigns the period 350-431 A. D. as the period to which the rise of the Krishna festival must be assigned," and when he opposes this alleged proof of Weber's with the words: "The legends of the Madonna were not known in Egypt until towards the close of the fifth century, and were probably derived from Italy," etc. Weber's main arguments for assigning the date 350 to 431 are in no wise founded upon the legends of the Madonna and her earliest representations with the Christ-child; he expressly characterizes these legends and pictures<sup>14</sup> as only a part of the material to be taken into consideration for the whole of the investigation; instead he has based the date 350-431 solely upon the reasons I have just cited. Hence Kennedy has here been guilty of hastiness.

<sup>12</sup> *Kr. Geburtsfest*, 337.    <sup>13</sup> *JRAS*, 1907, 483.    <sup>14</sup> *Kr. Geburtsfest*, 336.

In reality Weber's attempt to supply a date fails for the reason that Alexandria can not be taken into consideration as a medium of Christian transmissions, because by the beginning of the third century it has already lost its significance for the commerce of the world and especially for direct intercourse with India. Moreover, Christianity could not from a remote distance have exercised so strong an influence as is noticeable in Krishnaism. For this, direct contact was requisite. Weber also surrenders his date at once<sup>15</sup> and goes down to the year 640 as a date which would harmonize particularly well with the conclusions drawn from the age of the texts describing the birth festival of Krishna, or from their place in the history of literature. As is shown from an earlier passage,<sup>16</sup> Weber considers the year 640 as the *terminus ad quem*, because in that year Alexandria had been captured by the Moslems. Here again therefore we have Alexandria as the basis for argument.

Although Weber's *argument* in favor of the time shortly before 640 is untenable, yet this date agrees remarkably with the one which we must admit for a different reason. We have proof that the first Nestorian mission into central north India took place in the year 639;<sup>17</sup> and since there is no doubt that the Christmas festival and other Christian elements had been brought by the Nestorians into that region, that is, into the home of Krishnaism, the time (the first half of the seventh century) agrees very well with the age of the Purânas which are our earliest sources for the observance of Krishna's birthday. In this period, accordingly, occur the earliest Christian influences on Brahmanism, if we disregard the remote suggestion about the Christian religion which seems to be present perhaps a century earlier in the Shvetadvîpa legend of the Mahâbhârata.

<sup>15</sup> *Op. cit.*, 338.

<sup>16</sup> *Ibid.*, 323.

<sup>17</sup> "Contributions of Christianity to Buddhism, *Monist*, April, 1912, p. 179.



Before I enter upon the details of the Krishna festival, the fact deserves mention that the *season* in which this festival was and still is celebrated in India does not belong to loans from Christianity. The birthday of Christ was at first set for January 5th or 6th, March 28, April 19-20, May 20, November 19, and not until later for December 25; on the other hand Krishna's birth festival according to our sources was celebrated on different days, to be sure, yet always in the period between June and September.<sup>18</sup> Whether we have here a reminiscence of the actual time of Krishna's birth must remain unsolved.

The celebration of the birth festival does not pertain to Krishna alone but also to his mother Devaki, and he is represented as lying upon her breast in unmistakable imitation of Christian pictures of the *Madonna lactans*. The question with regard to the earliest appearance of Christian pictures of this kind, to which Weber<sup>19</sup> gives detailed attention, does not concern us here. For our purpose it is enough to know that the veneration of Mary and the representation of the Virgin and Child were current since the beginning of the Nestorian controversies in the fifth century.<sup>20</sup> Christian influence upon the Krishna festival is further very distinctly betrayed by the fact that in it the scene of the ancient Krishna legend—according to which Krishna was born in prison under circumstances of poverty and danger and was made away with in great haste and rescued by his father—appears in a completely altered form. The place of Krishna's birth has become a peaceful cattle stall (*gokula*) in which form for the festive purpose a confinement home (*sûtikâgriha*) is set up and is fitted out with a picture of the mother lying upon a bed with the divine child at her breast, and also with paintings or

<sup>18</sup> Weber, *Kr. Geburtsfest*, 338, Note 1.

<sup>19</sup> *Ibid.*, 324ff.

<sup>20</sup> In spite of Kennedy, *JRAS*, 1907, 483, 484.

sculptured representations of Krishna's father, of shepherds and shepherdesses, cattle, asses, etc., including all sorts of deities and demigods in the air.<sup>21</sup> Hence exactly the same as the scene among the shepherds after the birth of the Saviour is represented in Christianity for purposes of edification.

After the manger is set up and adorned as just described, the Krishna festival itself begins with the supplication and worship of the holy family at which many kinds of vegetable offerings are made, and the invocation of the mother of God (*devamâtar*) plays an important part.<sup>22</sup> The result of the whole festival is that the Christian stories of the birth of Jesus are widely known in their Indian garb among the Hindus down to the present day, even if otherwise they know nothing of Christianity.

#### PARALLEL MIRACLES.

In addition to the birth celebration, other features of the Christian legend have entered into the history of Krishna's childhood and later life. Here belong the tales of the Vishnupurâna, that the shepherd Nanda, the fosterfather of Krishna, was journeying by wagon at the time of the latter's birth with his pregnant wife Yashodâ to Mathurâ to pay his taxes (cf. Luke ii. 4, 5),<sup>23</sup> and that Krishna shortly before his entry into Mathurâ received a box of ointment from the crippled Kujâ and as a reward healed

<sup>21</sup> Weber, *op. cit.*, 248, 252, 272, 273, 280, 281.

<sup>22</sup> *Ibid.*, 284, 310.

<sup>23</sup> *Ibid.*, 338. Shortly before, Weber erroneously cites as Indian texts in which these loans exist, besides the Purânas and the Jaiminibhârata, the Harivamsha also and "some interpolated passages of the Mahâbhârata." The Mahâbhârata (according to Weber, 318, Note 5) treats Krishna's miracles in his childhood and youth in only one passage belonging to the latest interpolations (II, 1436-1445). Nevertheless, one who consults the text will not find there any parallel with Christian tales. Hopkins in *India Old and New*, at the bottom of page 165, has obviously made use of the above mentioned statement of Weber. But when he observes that in that passage of the Mahâbhârata the only deed of the child Krishna that is mentioned is the killing of a hawk, that is not correct; for in verse 1440 it is also mentioned that the babe overturns a loaded wagon.

the donor of her infirmity.<sup>24</sup> In this second story which is wrongly assigned by Weber<sup>25</sup> to no earlier source than the Jaiminibhârata, two or three familiar stories from the New Testament seem to be combined.<sup>26</sup> Krishna performed the cure by touching the crippled girl with his thumb and two other fingers on the chin, by lifting her head high while at the same time he pressed down her feet with his feet and so pulled her straight.<sup>27</sup>

With these tales belong the following which Weber has brought forward from the Jaiminibhârata, a Krishnaistic work of Purâna character, of whose age we can only say that it must have been composed before the beginning of the thirteenth century because at that time it was translated into Canarese.<sup>28</sup> The legend there given of the raising of the dead son of Duhshalâ by Krishna must be referred to Christian influence, because the older form of the story of Duhshalâ as it appears in the Mahâbhârata, XIV, 2275-2297, knows nothing of the awakening of the son.<sup>29</sup> Christian influence is at least very probable, because such things are not related of Krishna in the older sources, and in part it is certain in the accounts of Krishna's feeding large throngs of ascetics by a single vegetable leaf left

<sup>24</sup> Vishnupurâna, 5, 20. Kubjâ means "the deformed one"; the proper name according to the Vishnupurâna is Naikavakrâ, "She who is crippled in different places"; according to the Bhâgavata Purâna, 10, 42, 3, where the story is told in a similar fashion, Trivakrâ, "She who is crippled in three parts of the body" (back, breast and hips, according to Shridhara's commentary). Cf. Vishnupurâna, translated by H. H. Wilson, edited by Fitzedward Hall, Vol. V, p. 21 note.

<sup>25</sup> *Kr. Geburtsfest*, 339.

<sup>26</sup> Matt. xv. 30, 31; ix. 20ff. (Mark v. 25ff.; Luke viii. 43ff.); Luke vii. 37, 38.

<sup>27</sup> J. Kennedy, JRAS, 1907, 978, note 2, says: "The manner in which Krishna pulls the unguent-maker straight is exactly the way in which the youthful Christ makes two pieces of wood equal by pulling them out to the same length (Pseudo-Matthew, c. 37)." But here to be sure two very different things are made parallel.

<sup>28</sup> "Ueber eine Episode im Jaimini-Bhârata," *Monatsber. d. K. Preuss. Akad. d. Wiss. zu Berlin*, 1869, 12, Note 3; 34ff. The loans from Christianity, assumed by Weber, are to be found in the passages of the Jaiminibhârata. See pp. 37, 38.

<sup>29</sup> Weber, *Kr. Geburtsfest*, 315, Note 1; 318, Note 5; 339. *Indische Streifen*, II, 392, Note 2.

over in the corner of a pot; of the woman with an issue of blood who came to his feet seeking to be healed; of touching his foot as a means to avoid death; of his coming at once to bring help as soon as he is prayerfully besought; of the wish of a pious man not to die before he has seen him; and of the sin-redeeming power which Krishna's glance (or aspect), or the thought of him, or merely naming his name is supposed to have. The idea of the healing power of the water he washed in is at all events a transmission from an apocryphal Gospel.<sup>30</sup>

Thus far can we go with Weber. But we have shown above<sup>31</sup> that he is mistaken when he explains the narrative of Kamsa's persecutions and slaughter of children in this connection as a loan from Christianity. A similar judgment is to be passed upon what Weber says directly afterwards "of the carrying across the river (Christophoros)" without giving any explanation or proof of it. Hopkins<sup>32</sup> simply says it after him: "We find too in the history of Krishna the late Christophoros legend," and yet here, where we must reflect as to what after all Weber meant, an investigation would have been in place. Weber can not very well have had anything else in mind than that feature of the legend which treats of the rescue of the newly born Krishna whom his father Vasudeva carries across the Yamunâ in order to bring him to the shepherdess Yashodâ and to exchange him for her newly born daughter.<sup>33</sup> That on this occasion Vasudeva is obliged to ford the Yamunâ which readily lets him pass through its waters, accordingly, is the only ground upon which Weber here bases a transmission of the legend of St. Christopher! The pictorial representa-

<sup>30</sup> Weber (339, Note 2) refers to a passage in the Arabian Gospel of the Infancy.

<sup>31</sup> See *Monist*, July, 1913, p. 347.

<sup>32</sup> *India Old and New*, 166.

<sup>33</sup> Cf. the contents of Harivamsha in *The Monist*, July, 1913, p. 346, and Weber, *Kr. Geburtsfest*, 251 note.

tion of the scene on the accompanying plate should have served as a warning against such a hasty statement. A newly born child whom his father is rescuing from certain death by a hasty removal and exchange is certainly something very different from a boy placed upon the shoulders of a gigantic ferryman. I have previously shown<sup>34</sup> that the Christopher legend belongs in an entirely different connection in the relations between Indian and Christian religious literature.

#### THE SYSTEM OF AVATARS.

As with the two details just discussed, the case is the same with Weber's conjecture "that the entire Indian sect organization, in so far as it is founded on the exclusive worship of a single personal God, owes its origin to Christian influences," and with his assumption "that even the whole avatâr system has originated in an imitation of the Christian dogma of the descent of God."<sup>35</sup> This last assumption has already been contested by Lassen<sup>36</sup> on the obvious ground that Krishna was known as an avatâr of Vishnu even to Megasthenes, hence about 300 B. C. But still other points may be arrayed against it which are at the same time directed against Schroeder's conception.<sup>37</sup> According to his view the Brahman avatâr theory has been influenced by, and has indirectly arisen from, the Buddhist doctrine of the previous existences of Buddha according to which he had often been a god before his last birth (twenty times Indra and four times Brahman) and otherwise had appeared in the most divergent forms of existence. But the Brahman theory of avatârs is older than the stories of Buddha's previous existences which have their origin in

<sup>34</sup> "Contributions of Buddhism to Christianity," *Monist*, XXI, 550 ff.

<sup>35</sup> *Indische Studien*, II, 169.

<sup>36</sup> *Indische Altertumskunde*, 2d ed., II, 1126.

<sup>37</sup> *Indiens Literatur und Kultur*, 330.

the general belief in the transmigration of souls. This we know from the story in the Shatapatha Brâhmana of the supernatural fish that saved Manu from the deluge and in which, according to later interpretation, the god Brahman or Vishnu was incarnated.<sup>38</sup>

Vishnu's incarnation in the form of a fish stands at the head of the ten (later twenty-four or twenty-eight) avatârs, and because of its connection with the fish in the Shatapatha Brâhmana must be looked upon as the oldest idea in this cycle of myths. It certainly is not an accident that Vishnu appears in exactly the first four incarnations in animal form and in the six following in human form. The primitive worship of totem animals which merged into the Vishnu cult underlies the first forms, the fish, the tortoise, the boar and the (man-)lion. But it is not from this source alone that the avatâr theory is derived but from a combination of several. In the Rigveda all light phenomena are frequently conceived as forms of the fire god Agni. In 5, 3, 1, it is even said: "Thou art Varuna, O Agni, when thou art born; thou becomest Mitra when thou art kindled; in thee exist all gods, O Sun of power, thou art Indra to pious men," and in later portions the most different gods are explained to be only names for the *one* god. In the Yajurvedas and in the Brâhmana literature a number of gods are identified with earthly objects and existences: Pûshan with cattle, all gods with water, Agni Vaishvânara with the year, the earth, the sun; Prajâpati with the sun, the earth, the sacrifice; but mainly Vishnu with the sacrifice.<sup>39</sup> This ancient and genuinely Indian tendency towards identification—especially in its later manifestation in Vedic prose where it luxuriates in unrestrained fantastic, yea even idiotic, fashion—is

<sup>38</sup> Fischel, "Ursprung des christlichen Fischesymbols," *Sitzungsberichte der K. Preuss. Akad. der Wiss.*, 1905, 512ff.

<sup>39</sup> Schroeder, *op. cit.*, 134.

surely only a direct preliminary step of the train of thought which has brought forth the doctrine of Vishnu's avatârs and of the incarnation of other gods in remarkable men. There can here be no question of Christian influence.

#### CONCEPTION OF THE TRINITY.

Nor has the idea of the Trimûrti, the divinity manifesting itself in the three forms Brahman, Vishnu, and Shiva, which lies at the bottom of all Hinduism, anything to do with the Christian trinity; for it is pre-Christian and has reference to the ancient Indian idea of the sanctity of the number 3. Nevertheless the Christian doctrine of the trinity has exerted its influence on the later development of the Bhâgavata religion.<sup>40</sup>

The monotheism of the Bhâgavatas developed in remarkable agreement with the Christian conception into a doctrine of the simultaneous unity and trinity of the divine being, composed of God, his incarnations and his operative power (*shakti*). Since the god of the Bhâgavatas, the Exalted One (Bhagavat), has become one with Krishna and he in turn with Vishnu, his consort Lakshmi has been explained as the operative power of the Exalted One. In this without doubt the Sâmkhya doctrine of the Prakriti, creative nature, which is opposed to the spiritual principle, had some part; but also the Christian doctrine of the Holy Ghost, and this latter, indeed, in the form in which it existed among the Nestorians. Since the Semitic word for spirit (Hebrew, *rûach*) is feminine the Syrian Christians regarded the Holy Ghost as a feminine being and identified it directly with the Virgin Mary. When this is taken into consideration the correspondence between the doctrine of the Trinity as held by the Nestorian Christians and by the Bhâgavatas is extraordinarily close. In the latter the

<sup>40</sup> For the following paragraph Grierson's article "Bhakti-Mârâga," ERE, II, 542b, has been utilized freely; cf. also JRAS, 1907, 323.



Shakti (or its mythological personification Lakshmi) is regarded as one with the Exalted One and yet as different from him: "She has done everything that he has done and if we speak of him we speak also of her." At the same time Shakti appears as the active disseminator of the true faith which she has learned from him—hence as a separate person.

The worship of Shakti as a separate deity plays the most conspicuous part in the Shiva cult but only in the later Shivaistic sects. Hence we may assume that worshipers of Shiva who belong mainly to the lower classes have received it from the Bhâgavatas as they have similarly done in southern India with the doctrine of bhakti. Nevertheless in the Shivaistic (and related) sects the bhakti yields precedence to an ugly asceticism, to a monstrous trade in sorcery, demons and witches; then too the Shiva-bhakti has hitherto been but little studied so that when later on I shall treat the question of Christian influence on the modern development of the bhakti doctrine I may limit myself to the Vishnuistic sects, that is, to Vishnuites and Ramaites.

#### RAMAISM.

Heretofore I have only once briefly alluded to the Râmaïtes (*Mon.*, July, p. 339). Like the Krishnaites they originally formed a monotheistic tribal community and later spread all over India. Their god Râma originated in the same manner as the god Krishna, by the elevation of a human hero to divine dignity. Already in the Râmâyana the admired hero of the epic is deified and explained to be an incarnation of Vishnu, but only in such parts as are distinctly later additions and whose interpolation follows the purpose of impressing upon the reader or hearer the divine nature of Râma.

Krishnaism is older than Râmaism and even to-day is

more widely disseminated in India; but Râmaism is more deeply religious and more spiritual and therefore has its adherents mainly among the more cultured classes of Hindus who are filled with a yearning for contemplation and philosophy, whereas Krishnaism dominates more the well-to-do middle classes inclined towards a merry enjoyment of life.<sup>41</sup>

Râmaism is split up into two different sects which are distinguished not only by clothing and stripes on the forehead—all religious confessions among the Hindus are indicated by colored stripes and marks upon the forehead—but which are also violently hostile to each other, whereas their sentiments towards their common opponents are much more friendly. This is an illustration of a law apparently applicable to all mankind. With regard to their theological views the two Ramaitic schools, the southern and the northern, differ from each other in that the former professes the "cat doctrine," the latter the "ape doctrine." According to the cat doctrine, God (Râma) saves man like the cat takes up her young, i. e., without any participation and free will on the part of man; according to the ape doctrine, man in order to be saved must strive after God and cling to him as an ape to its mother. Here we have an Indian counterpart to the controversy between Calvinists and Lutherans.<sup>42</sup>

The two large religious communities of Krishnaites and Râmaïtes had not always been strictly separated from each other. The Bhâgavatas—or by their later name Pâncharâtras which first denoted a subdivision of the Bhâgavatas—were originally so exclusively worshipers of Krishna that for the earlier period we may use the expressions "Bhâgavata religion" and "Krishnaism" as synonyms. This is made clear enough in my exposition in two previous

<sup>41</sup> Hopkins, *Religions of India*, 427, 499; Grierson, *JRAS*, 1907, 501.

<sup>42</sup> Hopkins, *Religions of India*, 500, 501.

articles (*The Monist*, July and October, 1913). But when the Bhâgavata religion was reformed by Râmânuja in the twelfth century it was either already Râmaized or became so through the influence of its reformer; and this took place to a still greater extent through the best known of Râmânuja's successors, Râmânanda, who lived in the fourteenth century. However, the other Bhâgavata schools (that founded by Madhva at least in its north Indian branch) again made Krishna the object of their worship.

#### THE BHAGAVATAS AND THEIR SCHOOLS.

At any rate the Bhâgavatas were the first real monotheists and the first proclaimers of bhakti in India. Their faith, which I have above ("Christian Elements in the Bhagavadgîtâ," *Monist*, Oct. 1913, pp. 507ff.) represented as the contents of the Bhagavadgîtâ, they have in the main kept pure down to modern times, though it has undergone many sorts of further development, the most noteworthy of which are the doctrine of the 24 incarnations of the Exalted One, the last being still looked for; the classification of souls; and the development of eschatological conceptions in which are mingled Sâṅkhya-Yoga and pantheistic ideas. But the fundamental doctrines of the personality of God, of the eternal and individual existence of souls and of the supreme value of bhakti, the Bhâgavatas have always firmly maintained. From the twelfth to the fifteenth century four different schools (*sampradâya*) were established whose founders were Râmânuja, Madhva (or Anandatîrtha), Vishnusvâmin and Nimbâditya. The doctrines of these schools and their many subdivisions, which for the most part refer to the disputed question in what form the Exalted One is to be worshiped, cannot be separately discussed here.<sup>43</sup> We shall simply mention that in

<sup>43</sup> The best account of them is given by Grierson in the article already frequently mentioned ("Bhakti-Mârâga," *ERE*, II, 544ff.) to which I owe also

the third school whose principal representatives are the Vallabhâcâris, a love to God (Krishna) is demanded which does not bear the character of a son's love to his father but that between youth and maiden. By this means the sensual erotic element, which we have already met in earlier times and which matured some ugly outgrowths, has again been advanced in this branch of Krishnaism. It is interesting to see how the Vallabhâcâris reconcile with their own doctrines the Vedânta tenet of the absolute unity of the Brahman. They too ascribe its established attributes, existence, thought, and bliss (*Sach-chid-ânanda*) to the Exalted One as to the personally conceived Brahman; but the individual soul in its earthly existence they explain as the Exalted One in a condition in which the attribute of bliss is suppressed, and unsouled matter they explain as the Exalted One in a condition in which the attributes of thought and bliss are suppressed. Together with all other Bhâgavatas they reject the doctrine of cosmic illusion (*mâyâ*) and its consequences. At the moment of salvation the soul again obtains the attribute of bliss and becomes essentially equal with the Exalted One for all eternity. All other philosophical differences between the Bhâgavata schools are inconsiderable.

#### THE QUESTION OF CHRISTIAN INFLUENCE.

Those who wish to approach the question of Christian influence upon Hinduism must know as much about the religious currents which underlie it as I have here set forth. They must further know that Hinduism is in a constant flux and can absorb everything with which it comes in contact, as it has, for instance, absorbed the cults and deities of the Indian aborigines to the widest extent.

We have seen above (in *The Monist* of October, 1913)

much of my exposition in the following pages. Cf. also Grierson's essay "Modern Hinduism and its Debt to the Nestorians," *JRAS*, 1907, 311ff.

that the doctrine of bhakti and the fatherly love of God is of native Indian origin. Christian influences could find no better prepared ground than the home of this doctrine. Let us see now under what conditions Christianity has made its influence felt.

The Bhâgavata religion, the religion proper of love in India, which before its reformation was the possession of a superior class of people and was proclaimed in the language of the cultured and educated, the Sanskrit, lost ground in the course of time, lacking contact with the broader masses. It almost fell into oblivion since the ninth century when the higher intellectual life of all India came under the spell of Shankara, the great Vedânta teacher who brought the ancient half theistic and half pantheistic Brahmanism of the Upanishads into a unified and consistent philosophical system. The political transformations also and the terrible sufferings which the Mohammedan conquests had spread abroad over India since the beginning of the eleventh century were conducive to the collapse of the bhakti religion. Thus it happened that in the twelfth century this religion numbered only a few adherents living in the southern part of India. Nevertheless it awoke there to new life and with such success that since that time everything which goes by the name of Vishnuism in India is at bottom only a form of the bhakti religion.

It certainly is not an accident that this resuscitation of the bhakti religion took place in the close vicinity of the Nestorian colony of St. Thomé, the alleged monument of the Apostle Thomas at Mylapore not far from Madras. The Christians there had given up baptism at that time (but not the Lord's Supper) and had adopted some religious customs of Hinduism. This goes to show a close friendly community life with the Hindu sects in that locality, and a *mutual* exchange of religious elements. At the present day Christian altars may still be found in southern

India before which both Christians and Hindus worship, each in his own way.<sup>44</sup>

#### RAMANUJA THE REFORMER.

In the beginning of the twelfth century Râmânuja, the above-mentioned reformer of the Bhâgavata religion, was born at Perumbûr and received his education at Kâñchipura, now Conjeeveram. Both places are so near Mylapore that Râmânuja must have come in touch with the Nestorian Christians. I therefore agree with Grierson<sup>45</sup> that it must be due to their influence that Râmânuja, originally a follower of Shankara, the most important monist and scorner of bhakti, became converted to the Bhâgavata religion when a young man and devoted himself with great zeal to its propaganda, emphasizing, to be sure, the philosophical rather than the peculiarly religious side.<sup>46</sup> The Christian influence is clearly seen in some of his teachings which I shall discuss farther on. In his famous commentary on the Brahmasûtras, the main text-book of the Vedânta philosophy, Râmânuja sets forth very skilfully the conviction of all Bhâgavatas that the dogmas of their religion are in harmony with the main contents of the Upanishads.

A controversy in which Râmânuja refuted his old Vedântistic teacher engendered great bitterness towards the reformer, and persecutions compelled him to take to flight. But this proved of the greatest advantage to the faith he preached. Râmânuja's flight was the cause that the bhakti religion spread anew over the greater part of India from the most southerly point of the Himalayas.

<sup>44</sup> Grierson, JRAS, 1907, 312.

<sup>45</sup> *Ibid.*, 317.

<sup>46</sup> Madhva also, the founder of the second principal school of the Bhâgavatas, to whose faith he became converted in later years, was originally a Vedantist and like Râmânuja had lived within reach of Christian influence. He was born on the western coast of India about 1200 in Udipi near Kalyâna, the ancient episcopal see. Grierson, ERE, II, 549b, note.

The fact that this religion revived in southern India to new vigor and was again brought thence to the north where it continued to receive fresh sustenance from the south, is illustrated in an allegorical tale<sup>47</sup> of the Bhâgavata Mâhâtmya, an appendix of the Bhâgavata Purâna. Nârada relates (I, 27ff.) that in the current eon, Kaliyuga, he had wandered through all India without being able to find Righteousness. Finally he came to the banks of the Yamunâ, to the former scene of Krishna's exploits. There he met two old men lying at the point of death and a young woman mourning for them. To Nârada's question who she was, she replied: "I am Bhakti. These two are considered to be my sons. They are Knowledge (*Jñâna*) and Freedom from Desire (*Vairâgya*), and are become decrepit through the influence of (the present) time. . . . I was born in Dravida [eastern Dekkhan]; I grew up in Karnâta [on the south-western coast]; I became old as I dwelt sometimes in Mahârâstra [in the Mahratta country], and sometimes in Gurjara [Gujarat]. There under the influence of the terrible Kali Yuga, my limbs were mutilated by heretics, and with my sons I fell into a long continued feebleness. Since I came to Vrindâvana [on the left bank of the Yamunâ near Mathurâ] I have recovered and am now young and beautiful." She goes on to ask why her two sons have not also become young. Nârada explains that she has been rejuvenated by the holy influence of Vrindâvana, but that Knowledge and Freedom from Desire still remain old, as there is no one who will accept them.

The author of this story means to say that the doctrine of bhakti first originated in southern India and that thence it came north especially to the vicinity of Mathurâ where it attained a remarkable vigor. But he does not seem to have known that the *original* home of the bhakti doctrine

<sup>47</sup> Communicated by Grierson, JRAS, 1911, 800, 801.



was in the exact locality where he makes her regain her youth.

From this legend I now return to Râmânuja. The charming enthusiasm with which he proclaimed the comforting doctrine that a personal God who once appeared on earth in the form of Râma now lived in heaven and bore a part in all man's cares and sorrows, everywhere won the hearts of the oppressed. Râmânuja's disciples also traveled through the country, living only for the extension of their faith in abject poverty and everywhere gaining disciples and followers. It was a time of high strung religious excitement in which ecstasies, visions and alleged miracles were daily occurrences. In many places cloister-like establishments (*matha*) arose in which the mendicant teachers found temporary refuge and where they could end their days after they had become old and feeble.

#### CHRISTIAN INFLUENCE ON RAMANUJA.

Christian influence seems to me to have been exerted on Râmânuja not only in his theological fundamental conception but also in the following points:

Before his time sin had been regarded as disobedience to divine commands as set forth in the sacred texts, and as something to be avoided because of punishment which was certainly to be expected in a future life. After Râmânuja, the higher conception became dominant, that sin is what is not done in faith; that sin is sin because it does not agree with the nature of the God of love become flesh.<sup>48</sup>

Grierson<sup>49</sup> also considers as an imitation of Christian custom the extraordinary veneration which the Bhâgavata religion accords to the spiritual teacher. This veneration *might* have been strengthened by the Christian example, but at bottom it is genuinely Indian; for from time im-

<sup>48</sup> Grierson, ERE, II, 550, *ob*.

<sup>49</sup> *Ibid.* and JRAS, 1907, 323, 324.

memorial the teacher (*guru*) in India has always enjoyed just such an exaggerated regard.

On the other hand I agree with Grierson when he explains<sup>50</sup> the sacramental meal, which was celebrated in the Râmânûja community as well as in many other bhakti sects<sup>51</sup> under the name Mahâprasâda, "great mercy," and played a very important part, as an imitation of the Christian celebration of the eucharist. To be sure the correctness of this conception has been contested by Berriedale Keith<sup>52</sup> who with reference to Frazer's rich collections and to the investigations of Robertson Smith on the religion of the Semites, draws attention to the fact that such sacramental meals belong to the most widespread religious customs, that they are older than Christianity, and that they have been met with among peoples in a low stage of civilization who had as yet had no contact of any kind with Christianity. Without doubt this is right; but the manner in which the Mahâprasâda feast is celebrated shows a series of parallels with the Christian communion service which cannot rest upon chance. On the evening of the appointed day the community gathers together and the leading priest who is the celebrant (*mahant*) holds a discourse, after which the worshipers are given a short time for prayer and meditation. All withdraw who do not feel worthy to participate in the ceremony proper. The rest approach the celebrant in turn, and each receives in his right hand a small consecrated wafer and two other consecrated morsels. He then turns to another priest who pours a few drops of water upon his hand. This food and this water are thought to secure eternal life to those who partake and are worthy to receive it. Part of the sacra-

<sup>50</sup> *Ibid.*, and JRAS, 1907, 326.

<sup>51</sup> An exact description of the ceremony as it is practised among the Kabirpanthis is given by Foss Westcott in *Kabir and the Kabir Panth*, 1908, 127.

<sup>52</sup> JRAS, 1907, 492, 493, 939.

mental food is retained and carefully treasured to use for sick people.

Grierson is also right in referring the instigation of the introduction of the Mahâprasâda ceremony to the Nestorians in southern India instead—as others have done—to the Jesuits at Akbar's court. The following arguments contend against the latter assumption: (1) The wide dissemination of the Mahâprasâda celebration over all India; (2) its frequent mention in the Bhaktamâlâ (to be discussed later); and (3) the fact that among the Kabirpanthis the ceremony is followed by a great love feast which is not a Roman Catholic institution but which was customary among the Christian communities of the early days and which was retained by the Christians of southern India who were shut off from the rest of the world.

Moreover Christian influences may be recognized in Râmânuja's doctrine of the equality of all castes. Nevertheless Râmânuja did not put into practice this humane fundamental principle, for in his time all teachers and leaders of the new community were exclusively Brahmans, and people of lower castes were not even admitted as pupils into the clergy. But exactly the circumstance that the principle of universal brotherhood remained a theory with Râmânuja may be looked upon as an indication that it was established at Christian instigation. When Râmânuja accepted from the Christians the doctrines which he heartily shared, he did not wish to reject that of the equality of all mankind although it was not sympathetic to him, a born Brahman. He adopted it but made no use of it.

#### THE REFORMER RAMANANDA.

His successor Râmânanda at the end of the fourteenth century was the first to take seriously the equality of rights of all castes. Like Râmânuja, Râmânanda was also under direct Christian influence, and like Râmânuja also he en-

tered into controversies with his teacher Râghavânanda, the head of the cloister founded by Râmânuja in Seringapatam. The occasion of the dispute shows how greatly this teacher and the band of scholars surrounding him were entangled in Brahman caste prejudice. Râmânanda had made extensive pilgrimages upon which, according to the opinion of his fellow pupils which Râghavânanda shared, he could not have observed punctiliously all the Brahman food regulations. He was therefore condemned to take his meals alone apart from the other pupils. This ridiculous quarrel was of extraordinary advantage for the religious life of India; for it resulted in an immense extension of the bhakti religion. Râmânanda was highly enraged at the indignity done him and determined to emigrate to northern India where he founded the sect of the Râmânandis.

The great service of this man for the advancement of the bhakti religion, which in the half-century following his death was the most widely spread in India, consisted of the following innovations. He departed from the prevailing custom of preaching and writing in Sanskrit, and by the use of the vernacular made the doctrines of his religion accessible to all classes of the population. At the same time he put into practice the principle of the brotherhood of man by admitting members of all, even the lowest castes, not only as members of his sect but even as teachers. Evidently borrowing from the details of primitive Christianity, Râmânanda gathered *twelve* disciples about him, among whom were a hair-dresser, a worker in leather,—hence men from greatly despised castes—and the Mohammedan weaver Kabir who together with Mohammedan doctrines accepted Christian doctrines especially and rejected every sort of idolatry. Kabir taught that all religious externalities are without avail and that everything depends upon the inner man. Some sayings of Jesus he translated

almost literally and spoke of the "Word" in expressions which can only be a paraphrase of the beginning of John's Gospel: "In the beginning was God alone, but from him went forth the Word. When God desired that creation should come into being, he gave command through his Word and so through the Word were all things made which exist. Although the Word proceeded from God, yet is it not different from God but abideth in him, as thought abideth in the heart of man. God's voice sounds in order that men may have knowledge of the Word; and so the Word is in the world and at the same time with God."<sup>53</sup>

#### MODERN SECTS.

Like the number twelve of the disciples of Râmânanda, so the number ten of the commandments in the Bhâgavata school founded by Madhva is apparently an imitation of Christianity, even though their contents agree with the Christian ten commandments only in very broad outlines: "Thou shalt not lie, slander no one, use no harsh words, talk not idly, steal not, commit not adultery, kill not, think no evil, hate not, and be not proud."

In the sixteenth and seventeenth centuries the influence of the modern Christian mission upon the spiritual life of India had already become so strong that religious disputations between Hindus, Mohammedans, Christians and Jews were a daily occurrence, as we learn from the *Dabistan*, a Persian work written in the year 1645.<sup>54</sup> Although obviously modern relations do not properly belong in the scope of my exposition yet I will mention two works of this period filled with Christian influences which have exerted and still exert a very important effect upon the religious life of India. I mention these works especially because the millions of Hindus who read them with enthusiasm do not

<sup>53</sup> Grierson, *ERE*, II, 550a; *JRAS*, 1907, 325 according to the communications of Foss Westcott.

<sup>54</sup> Hopkins, *Religions of India*, 510 note.

know that it is the Christian spirit which speaks to them from many passages of these books. These are the Hindi version of the Râmâyana by Tulasidâsa (Tulsidâs) and the Bhaktamâlâ of Nâbhadâsa (or Nârâyanadâsa) likewise written in the earlier Hindi dialect. Both authors wrote towards the end of the sixteenth century and were teachers of the Râmânandî sect; but their works are esteemed equally highly by the other Bhâgavata schools.

## TULASIDASA.

Talusidâsa (1532-1623) in several works—but especially in his vernacular Râmâyana, which however is not a translation of the ancient Râmâyana of Vâlmiki but an independent exposition of its contents, with the proper title *Râm-charit-mânas*, “The Lake of Rama’s deeds,”—preaches a strict ethics and especially man’s duty towards his fellows, and in so doing has touched the note which speaks to the heart of the masses. If the atrocity and filth of Shivaism and the sexual licentiousness of later Krishnaism have been checked in modern India it is mainly due to the influence of this work and the teachings of Talusidâsa as a whole. His Râmâyana is found alike in peasants’ huts and Râjâs’ palaces, and in the market places are to be seen public readers of the poem surrounded by attentive listeners of all classes. The book has been made accessible to the Occidental public in an excellent English translation by F. S. Growse (three volumes, 5th ed., Cawnpore, 1891).

The fundamental features of the religious doctrine of Talusidâsa in which Christian influence is unmistakable may be summed up as follows:<sup>55</sup> Man is by nature thoroughly corrupt and unworthy to be saved from the consequences of sin, but the supreme being in his infinite mercy has descended to earth and has become man in the person of Râma in order to redeem the world from sin. Having

<sup>55</sup> With Grierson, JRAS, 1903, 456, 457; 1907, 320.

returned to heaven God knows from his own experience how great are the weaknesses and temptations of man, and he practices infinite mercy in constant readiness to help the sinner who invokes him. Even the worst criminal who earnestly repents is thereby purged from sin.<sup>56</sup> From these fundamental conceptions are derived the duties towards one's fellows and the doctrine of the brotherhood of man.

The other divinities of Hinduism are subordinate to God (Râma) and are thought of as standing in a relation to him which is comparable to that of the angels and saints towards God as it is conceived in the Roman Catholic church.<sup>57</sup> Particularly noteworthy in this connection is the position of Hanumat who always appears as Râma's personal servant in heaven. Grierson relates a beautiful legend which, though not told by Tulasidâsa himself, may be traced to his direct influence.

A miserable crossing-sweeper suffering from a repulsive disease lay in a wretched muddy place and cried in his misery: "Ah Râm, ah Râm! (O God, O God!)." Hanumat was flying by at the time and angry at hearing the name of his Lord cried in such disgusting surroundings struck the man on the breast. That evening when according to his usual custom he was rubbing Râma's body he observed a frightful wound upon the god's breast. Horrified Hanumat asked what had happened. "Thou gavest a poor man a blow on the breast when he invoked my name, and what thou hast done unto the least of my children thou hast done unto me."

#### THE BHAKTAMALA.

The other work above mentioned, the Bhaktâmâla of Nâbhadâsa with the commentary of Priyâdâsa, Grierson calls the *Acta Sanctorum* of the four great Bhâgavata

<sup>56</sup> *Ibid.*, 1903, 454, 455.

<sup>57</sup> Grierson, JRAS, 1903, 457-458.



schools.<sup>58</sup> Not only the main doctrines of this work but many details in it betray Christian influence as distinctly as can be. Thus we have the legends of Gopâla who when he received a blow upon one cheek offered the striker the other also (Bh. 106 = Matt. v. 39); of Vilvamangala whose eye offended him because he had looked at a woman with desire and who therefore blinded himself (Bh. 46 = Matt. v. 29); and of the anonymous king of Purî who for the same reason chopped off his right hand and cast it from him (Bh. 51 = Matt. v. 30).<sup>59</sup> In Bh. 204 are given examples of the kindness which the incarnate God has manifested toward his servants. One of these is that Krishna washed the feet of his servants. Even in Mahâbhârata II, 1295, it is related how Krishna demeaned himself to wash the feet of Brahmans; but in the Bhaktamâlâ we have instead of Brahmans "*santas*, i. e., the bhakti-filled." The original Indian legend therefore seems by this alteration to have been brought into harmony with the New Testament narrative (John xiii. 5).<sup>60</sup>

#### AVENUES OF CHRISTIAN INFLUENCE.

That the Christian influences upon the various Bhâgavata schools which we have here discussed originated, as far as the time before the sixteenth century is concerned, with the Thomas Christians of southern India may be regarded as certain. After the sixteenth century the bhakti

<sup>58</sup> "It is a storehouse of legends regarding the saints, ancient and modern, of the Bhâgavata religion. The importance of this book for a just comprehension of the religious attitude of modern Hinduism cannot be overrated, and it is a matter for regret that the great difficulties of the text have deterred European students from its study. In its original form few natives can understand it nowadays, but numerous translations into modern Indian languages have made its contents familiar to every follower of the cult. For northern India, it and Tulasi-dasa's Râmâyana are the two text-books of modern Bhâgavatism." ERE, II, 546a. The contents of the work are given in detail by Grierson in his essays, "Gleanings from the Bhaktamâlâ," JRAS, 1909, 607ff.; 1910, 87ff., 269ff.

<sup>59</sup> Grierson, JRAS, 1907, 322, 496; ERE, II, 548b.

<sup>60</sup> Kâshiprasâ Jayaswâl in Grierson, JRAS, 1907, 322, Note 5.

sects of northern India may have gained new support from Christian missions. But almost all the notable bhakti teachers from Râmânuja to Nâbhadâsa—that is, from the twelfth to the end of the sixteenth century—were from southern India and must therefore have received their Christian impulse from the Thomas Christians in southern India who possessed a Christianity that was distorted in many respects.

This disposes of the assumption of J. Kennedy and others that Christian influences effected the revival and reform of the bhakti religion through the mediation of Persian sûfism. Sûfistic influence can be considered only for the bhakti sects of northern India that developed in Mohammedan surroundings, and for a later time. With this limitation, however, it must be recognized.<sup>61</sup> The previously Mohammedan Kabir (beginning of the fifteenth century) mingled Christian and sûfistic doctrines; and the modern bhakti sect (founded towards the end of the sixteenth century) of the Râdhâsvâmins (or Râdhâvallabhis) is based upon Kabir, the sûfis, and the Gospel of John.<sup>62</sup>

Although several bhakti teachers have departed from those principles of Brahmanism which it has considered from time immemorial as basic pillars of the religious system, yet they have not severed connection with Brahmanism. Even the reformers of the present time, in spite of the closer relations to Christianity in which they find themselves, have held fast to certain elements of Brahmanism or have started from them.

#### BRAHMA SAMAJ.

Râm Mohan Roy (1772-1833), the founder of the Brâhma Samâj, and his successors in the leadership of this philanthropical sect, are especially to be mentioned in this

<sup>61</sup> Grierson, *ibid.*, 501-503; ERE, II, 550b.

<sup>62</sup> J. Kennedy, JRAS, 1907, 487, unfortunately (as so often) without authorities.

connection. It is well known that the Brâhma Samâj endeavors to obtain man's higher happiness through a conciliation of the great religions by rejecting all special forms of worship. Râm Mohan Roy started with the pantheism of the Upanishads but later attained to faith in a personal God, and although he never relinquished his membership in the Brahman caste confessed in the course of his spiritual development more and more a leaning to the teachings of Christianity, which he declared to be the best of all religious doctrines. He came finally to believe in the last judgment, in the founding of the true religion by Christ and in the miracles ascribed to him. But the dogma of the trinity he resolutely rejected.<sup>63</sup>

Of Râm Mohan Roy's successors we need only mention Keshab Chunder Sen who departed from all the prejudices of Hinduism and laid aside the sacred cord, the mark of his caste. As he did not succeed in introducing his far-reaching reforms into the Brâhma Samâj he founded in 1866 a new church under the name "Brâhma Samâj of India" which received its religious stamp from the ecstatic form of the bhakti. With his own peculiar ardor Keshab Chunder Sen in the year 1880 proclaimed his faith in the truth of Christianity in the following words: "It is Christ who rules British India, and not the British government. England has sent out a tremendous moral force in the life and character of that mighty prophet to conquer and hold this vast empire. None but Jesus, none but Jesus, none but Jesus, ever deserved this bright, this precious diadem, India, and Jesus shall have it. . . . Christ is a true Yogi."<sup>64</sup> But to Keshab Chunder Sen, in spite of this paeon, Christ was merely an ascetic corresponding to the Brahman ideal, and at a later time K. Ch. Sen set up a combination of

<sup>63</sup> Monier-Williams, *Brahmanism and Hinduism*, 488; Hopkins, *Religions of India*, 516.

<sup>64</sup> Monier-Williams, *op. cit.*, 516; Hopkins, *op. cit.*, 521.

Hinduism, Islam and Christianity as the true religion. Nevertheless in these progressive reformers Christianity formed a strong support for their religious conviction. It has on the whole exerted the most beneficial influence on the Brâhma Samâj in its various stages of development, not only in dogmatic but also in moral and social respects. In its Sunday services sections from the Bible are now read side by side with those from the Veda, the Avesta and the Koran.

J. M. Farquhar<sup>65</sup> gives the number of Brâhma Samâj congregations at the time of K. Ch. Sen's death in 1884, as 173 with about 1500 covenanted members and about 8000 adherents; the census of 1901 gives 4050 members (as against 3051 in the year 1891). These statistics show that there have always been only small congregations and that the whole movement, as was to be expected, has remained limited to the most intelligent classes.

Apart from this consciously eclectic movement it is not easy properly to estimate the strength and extent of Christian ideas which have entered into the Hinduism of to-day through various avenues. Grierson, the most competent judge of these imponderabilia and the best expert in the modern (vernacular) religious literature of northern India which is but little known in Europe, has given the following noteworthy statement: "I approached the terrain with a mind absolutely free from preconceived ideas, and with altogether different objects. At first I was struck with what I thought were coincidences, but as I went on and grew more and more familiar with the country, the Christian element in the atmosphere was more and more impressed upon me. There was plenty of nitrogen and carbonic acid, not to speak of argon, but the oxygen was identical with the teaching of our Gospels. This is a case of impression, which it is impossible to justify by formal

<sup>65</sup> In the extensive article "Brâhma Samâj," ERE, II, 821a.

proof; but there it is, and I offer it for what it is worth."<sup>66</sup> With these words we must combine what Grierson has said in another passage<sup>67</sup> with special emphasis: "At the present time it cannot be too emphatically stated that modern Hinduism is at its base a religion of monotheism. (Foot-note to this passage:) The gross cloud of combined polytheism and fetishism which covers and hides this monotheism, is kept, even by the unlearned Hindus, upon a different plane of thought. The monotheism has to do with the future life and with what we should call 'salvation.' The polytheism and fetishism serve only for the daily needs of the material world. In a country where, as in India, the majority of the people are poor and ignorant, the material overshadows the spiritual; but even the poorest recognizes (even if he think them too high for him) the truth of the doctrines concerning the One Supreme Being, which have descended to him from the Bhāgavatas."

It is not easy for me to contradict a scholar of Grierson's eminence who has lived for a generation among and with the Hindus and for this long period has devoted much of his best strength to the investigation of their religious conditions. But here we have a judgment of a wholly subjective character. I therefore believe that although my stay in India extended only over a year and a half, I am not required to withhold my conviction that Grierson in his sympathetic enthusiasm overestimates the scope of monotheistic tendencies and the Christian elements in the Hinduism of to-day. I have throughout received the impression that polytheism and fetishism form essential characteristic features of Hinduism and do not merely lie above it like a fog concealing its true nature!

In the introduction to the exceedingly valuable article "Bhakti-Mārga"<sup>68</sup> which I have frequently cited, Grierson

<sup>66</sup> JRAS, 1907, 500, 501.

<sup>67</sup> JA, 1908 262.

<sup>68</sup> ERE, II, 539a.

says that the doctrine of the bhakti forms the foundation of the modern Vishnuitic Hinduism, and that at least 150 millions of the inhabitants of India profess it. Now according to the census of 1901 the number of Hindus amounts to 207 millions, and this includes—besides eight and a half million animists—the rural population which still constitute the majority in India and whose religion consists in fact in the worship of a vast host of racial and local deities. Further deducting the great mass of Shiva-ites we find that Grierson has estimated the number of Vishnuites (Râmaïtes and Krishnaïtes) much too high.

Among the number of Christian elements demonstrable in Indian literature which I have collected in the last part of this essay probably nothing of importance is omitted. We must grant that these Christian additions are pretty considerable in number from the seventh century on and represent a valuable enrichment of Indian religious wealth; but it must not be maintained that they occupy any overwhelming place in their surroundings. *In the whole religious atmosphere* of the Hinduism of to-day Christian elements naturally play a less important part than in the literature belonging to the educated classes.

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## CEREMONIAL SPITTING.

THAT a volume might be filled with citations of cases of ceremonial spitting is familiar to every ethnologist. So large a body of material need not be presented in any study of the significance of the rite. Its origins are probably includible in a short paper. Three suggestions are presented here for consideration.

### I.

Bulwer-Lytton, in the amphitheater scene in the *Last Days of Pompeii*, makes the furious and frenzied Calenus carry the day against Arbaces by going into convulsions and shouting "A god! a god! I feel the god rush to my lips!" This view of epileptic and convulsive seizures is world-wide, and is familiar enough in general literature, classical and modern. But since foaming at the mouth as well as tremors, prove to the primitive mind the presence of some superhuman agency, the conclusion is easily reached that inspiration or obsession is readily communicable by means of the saliva of the convulsed or inspired person. This hardly means that the effect has been everywhere taken for the cause; rather would it appear to be an illustration of the failure of primitive minds clearly to dissociate matter and spirit in their thinking—a leading factor in all animistic beliefs. Two sharply defined, independent realms are, I think, not at all conceived at first, and because of this fact, mysterious powers of inspired or holy men are widely



considered communicable by some form of physical contact, just as heat and cold, or color of inks, or dyes, may be communicable.

So in the Semitic world, the *baraka* or "blessing," the mysterious powers of a holy or inspired man, are communicated by the saliva. At initiation into a dervish order the sheikh or head of the order spits on the hands and forehead of the candidate; among the Rufaiyeh the custom is to spit in the candidate's mouth.<sup>1</sup> The like custom is general throughout North African states; every candidate for "holy orders" and every suppliant of a holy man, is likely to have his mouth spit in, as a token of divine favor.<sup>2</sup> So in Central Africa the head priest of the Warua spits in the face of any inquirer whom the god delighteth especially to honor.<sup>3</sup> I doubt if in this case, however, any special powers are acquired by the recipient. In the cuneiform literature the same conception is prominent. The word of a god comes upon a man, and is indicated by shivers or tremors of the *bārū*, "seer," or *sha'ilu*, "necromancer" or medium.

We read of Bēl Marduk,<sup>4</sup>

"His word is brought upon the *bārū*, and that *bārū* shivers.

His word is brought upon the *sha'ilu*, and that *sha'ilu* shivers.

His word is brought upon the *idlu* (youth?) in woe(?) and that freeman moans.

His word is brought upon the maiden, and that maiden moans."

Jastrow<sup>5</sup> cites fifteen lines about Nergal, in which the above also occurs. He thinks some plague is meant. I

<sup>1</sup> Bliss, *Religions of Modern Syria and Palestine*, 218.

<sup>2</sup> Montet, "Le culte des saints dans l'Islam," *Hibbert Journal*, July, 1909.

<sup>3</sup> Cameron, *Across Africa*, 315.

<sup>4</sup> Banks, *Sumerisch-babylonische Hymnen*, 9.

<sup>5</sup> *Die Religionen Babyloniens und Assyriens*, 475-6.

doubt if that is the only effect of the "word of Nergal" that is intended. The passage I quote describes fairly what any one may see in a seance to-day in America, when a medium is going "under control," and is interesting as indicating transition from the cult and inquiry of the dead to a conceived greater power, a king of the dead, as both Bêl and Nergal are sometimes conceived. Compare Ezekiel's dumb seizures and David's slobbering madness. The process of communication is the same. Take this specimen:<sup>6</sup>

"The *ashipu shangumahhu* of Ea am I,  
The messenger of Marduk am I;  
To revive the sick man  
The great Lord Ea hath sent me.  
He hath added his pure spell to mine,  
He hath added his pure voice to mine,  
He hath added his pure spittle to mine,  
He hath added his pure prayer to mine."

It is a fair conclusion that this ancient Semitic physician, priest or exorcist received inspiration by having his mouth spit in, at ordination, like his modern confrères. The purifying power of spittle, especially of the gods, is familiar in ancient Egyptian texts, the spittle of Horus and Set<sup>7</sup> suggesting that of Marduk and Nergal. In Mark vii. 33, Jesus spits and touches the tongue of a stutterer—I suspect with saliva—to give fluency of speech.

This power of spittle to impart the gift of speech is very prominent in folk-tales. Miss Cox cites fourteen tales from Russia, Scotland, Hungary, South Africa, Poland, India, Germany and Scandinavia, in which spittle will speak when spat upon the ground and questioned; or, since in most cases some object spat upon thus acquires the gift of speech, perhaps we should conclude that the

<sup>6</sup> Thompson, *Devils and Evil Spirits of Babylonia*, 13.

<sup>7</sup> Budge, *Osiris and the Egyptian Resurrection*.

earth acquired this power when spat upon, in older forms of the tales. "In the Edda, the spittle of waves was shaped by the gods into a man, whose blood, when he was slain, was mixed with honey and made into mead of which if a man drink he becomes a poet and a sage."<sup>8</sup> In this case three familiar sources of inspiration, spittle—perhaps of a sea god—blood-drinking and mead-drinking, have been fused into one myth. In the *Folk Tales of the Magyars* (p. xxxiii) the fairy Helena confers the gift of speech upon the floor, the door handle and the hinge, by spitting upon them.

Among the Zulus, the diviner infuses power or vitality into his divining sticks or chips—substitutes for ancestral bones—by spitting upon them. They then leap about, and by their motions reveal to him anything he wants to know.<sup>9</sup> The like custom in using the divining bones is widespread in Africa; and the superstitious negro "crap shooter" in our own land still attaches importance to his spitting in "throwing the bones."

In Africa we find this same deputation of authority by spitting. Old Katchiba, appointing his brother as guardian and deputy weather clerk for Sir Samuel White Baker on leaving Obbo, breaks a branch from a tree, spits upon it several times, and lays it on the ground. A fowl is dragged around it, and rubbed over the feet of Baker's horse before being sacrificed. The "blessed branch" is then given to Katchiba's brother. With this magic wand, and a rain-whistle of antelope's horn hung upon his neck, he enters upon his duties. Later, Katchiba learned that Baker and his wife were sick. Liberally "blessing" a branch and waving it about their heads, he then stuck it in the thatch over the door of the hut as a guardian power; evidently the evil could not return while this strong armed

<sup>8</sup> *Cinderella*, p. 518, note 69.

<sup>9</sup> Callaway, *Religious System of the Amazulu*, 330.

spirit kept the house. As the sick people undoubtedly recovered, who can deny the potency of a branch so blessed?<sup>10</sup>

Fetish-making, as every ethnologist knows, is inducing a spirit to take up its residence in some convenient object which the maker or buyer then carries about with him for his own protection against other powerful spirits. It is natural then for the African in many cases to conclude his process of manufacture by spitting upon the magical device, and the value of the rite depends upon the rank of the spitter. Thus in making the great traveling or war fetish in Garenganze, the final step is the spitting upon it by the king.<sup>11</sup> To be classed with this process probably, is the custom among the neighboring Barotse, of protecting an article from thieves by spitting on straws, and sticking them around it.<sup>12</sup> But this may mean that the straws thus acquire the gift of speech and will betray any thief.

Comparable with Katchiba's "blessing" a bough with "holy water," cited above, is the experience of Captain Stigand at a Rendile festival. Every one is expected to have the branch of a certain bush fixed upon his hut upon such occasions, so two elderly masters of ceremonies brought the English captain a bough and spat upon it; and added thereto a spitting upon his hands by way of benediction.<sup>13</sup>

## II.

The spitting of reverence is one of the most wide-spread of customs. Daniel Crawford, in *Thinking Black*, several times speaks of the African as trained in "the university of the beasts." Carl Lumholtz in his *Unknown Mexico* describes dances to produce rain which the Indian claims

<sup>10</sup> Baker, *Albert Nyanza*, 207, 211, 250.

<sup>11</sup> Arnot, *Garenganze*, p. 207.

<sup>12</sup> Declé, *Three Years in Savage Africa*, 72.

<sup>13</sup> *To Abyssinia Through an Unknown Land*, 101-2.

were taught him by the deer, the turkey, etc. In *New Trails in Mexico*, the "Frog Doctor" teaches rain making; that is to say, the curious behavior of some animals before a rain is construed as a cause, not as an effect. It is a rigid application of *post hoc, ergo propter hoc*, and so in various parts of the world animals behaving oddly before a rain acquire a reputation for rain making. In like manner, the animal mode of expressing affection does not pass unnoticed. "If I were a cow with a long tongue, I would lick you all over," said an African chief to John Campbell<sup>14</sup> by way of welcome. So we have courteous greeting by way of licking or spitting all through Africa, and a logical expansion into ceremonial worship. Dr. Nassau tells us that in West Africa one blows, puffs, or spits a blessing upon the head or hand of a child, so that the word *tuwaka* may be understood to be "bless" as well as "spit."<sup>15</sup> In modern West African custom it is commonly a sharp puffing with no emission of saliva, suggesting transition into "breathing a blessing"; but the name for it, "spitting," remains. Among various tribes in South Africa when a child is born various sacred herbs are hung up at the door of the hut, and every visitor to the babe must chew some of these, and spit or puff at the child. A mother absent from her child a short time chews some herbs hung around the child's neck and puffs at it.<sup>16</sup>

Dr. Schweinfurth<sup>17</sup> saw the spitting rite as expressive of fidelity, reverence or attachment, only two or three times while in Africa and thought the custom dying out; but in other parts of the continent it is still in full vigor. In Dinka Land an English official may be met by native chiefs who crawl to him on all fours and spit in the palm of his hand by way of showing good faith. Another form

<sup>14</sup> *Travels in South Africa*, II, 185.

<sup>15</sup> *Fetichism in West Africa*, 99, 213.

<sup>16</sup> *Savage Childhood*, 16, 44.

<sup>17</sup> *The Heart of Africa*, I, 205.

is to lick the palm of his hand.<sup>18</sup> Compare the fact that the son of an African chief may speak of himself as "father's little dog" and the inference is fair that the behavior of a suppliant dog suggested this rite of submission, or the like one of licking or kissing the feet, common in some parts of South Africa and a commonplace in Assyrian royal inscriptions. Among the Nuehr, the salutation is to spit in the face for especial honor. In case of ordinary salutations between friends the hand is held up with spread fingers at the height of one's head, and the friend spits in it.<sup>19</sup> Mr. Petherick in the same region tells of his first experience with the custom. A Nuehr chieftain entered the cabin of his steamer, knelt, and grasped the trader's right hand, spat in it, then full in the white man's face. Astounded, but seeing only benignity in the black face before him, the trader restrained the impulse to knock him down and returned the compliment with great fervor, much to the delight of the old chief, who was thereby assured that Petherick himself was a man of the highest rank.

It is easy to see that if the custom itself is construed as a token of kindness, affection, or favor, it will be esteemed in proportion to the rank of the spitter. There is no difficulty in understanding the esteem of such favors where no peculiar powers are believed transmitted thereby. Thus in Unyoro at a marriage, the priest of the Bachwezi, or ancestral spirits, spits upon the heads of the pair kneeling before him by way of blessing them. The subsequent rite of killing a sheep, blessing it, presenting some of the meat to the ancestor and some to the kneeling pair, following with a like communion with a cup of banana wine, strongly suggests Christian influence,<sup>20</sup> which the presence of Gallas as Unyoro herdsmen would explain, since Chris-

<sup>18</sup> Mrs. Stevens, *My Soudan Year*, 134-136.

<sup>19</sup> *Ibid.*, p. 218.

<sup>20</sup> A. B. Lloyd, *Uganda to Khartoum*, 52.

tianity once had a foothold among the mountain Gallas of Abyssinia,<sup>21</sup> who still retain a baptismal rite and eucharist, though heathen in all other respects. An infant in Unyoro is blessed at birth by being brought to the priest for him to spit upon.

Similarly, among the Nubas, the priest blesses a child by spitting upon its chest, and there is a christening ceremony in which the child and the relatives are sprinkled by means of a slain chicken dipped in water, and then spitting upon the child.<sup>22</sup>

The very word "spitting" may be used as a synonym for "blessing," or gift. Among the Thonga a groom will probably pay for his wife in cattle, but he may add to the stipulated cattle a present of one sovereign to the bride's father, saying "This is my spitting for you, my father."<sup>23</sup>

Throughout Marotseland, spitting is universal at greeting or parting, and enters into pledges of fidelity and business contracts to some extent, as may readily be inferred. But only children of royalty or near relatives may enjoy the great blessing of being spat on by the king. Declé remarks that actual emission of saliva is unusual; Marotse spitting is merely ceremonial. The distinctions of rank are sharply drawn in spitting; Brazilian Indian chiefs are known to spit in hands of attendants or associates.<sup>24</sup> So the king of Uganda expresses pleasure with those who salute him by blowing and spitting in their hands, which the ardent loyalist promptly rubs on his face and eyes.<sup>25</sup> Spitting is also the chief feature in a Makoba chief's blessing.<sup>26</sup>

<sup>21</sup> Krapf, *Travels in East Africa*, 378, 385.

<sup>22</sup> Mrs. Stevens, *My Soudan Year*, 274, 277.

<sup>23</sup> Junod, *Life of a South African Tribe*, I, 119.

<sup>24</sup> Declé, *op. cit.*, 77; Coillard, *On the Threshold of Central Africa*, 311-12, 369, 394, 469, 524.

<sup>25</sup> Stanley, *Through the Dark Continent*, I, 252.

<sup>26</sup> Chapman, *Travels*, I, 160, 194.



It is clear that amongst a people more democratic or less centralized in organization such salutations are mutual; the rite does not become a mark of rank. So among the Masai and neighboring Wachaga, spitting or spirting water upon each other at meeting, parting, receiving presents, making brotherhoods, or pledges of eternal friendship, in closing contracts, is everywhere in evidence. At closing a trade each man spits upon the article he barter away.<sup>27</sup> The Wachaga kill a sheep or goat in their brotherhood ceremony, each party solemnly spitting on its head; or they spit milk or beer in each other's mouths. The primitive affectionate "cowslick" and "puppy love" could hardly be carried further than it is by these nomadic pastoral peoples. The Akikuyu also spit in all ceremonies of respect and reverence.<sup>28</sup>

Probably derived from this licking or spitting as a mark of respect or esteem is the custom of spitting on the food or drink one offers to an honored guest, especially prominent in some parts of the Malay Archipelago; or the guest's spittle will be a mark of his own esteem. St. John<sup>29</sup> tells of his hospitable reception in a Dyak village. His visit being of good omen for the simple villagers, they bring balls of rice for him to spit on, which they eagerly swallow. Not so easily endured by the civilized visitor is the reverse custom, as on the occasion when the American General Bates and his staff paid a diplomatic visit to the dowager Sultana of Sulu. When refreshments were brought in, one of the chieftains gravely spat a mouthful of betelnut juice in the bowl of liquor provided, which mark of royal favor the visitors were expected to appreciate very highly.

Another interesting advance upon the spitting at greet-

<sup>27</sup> Hinde, *Last of the Masai*, 42-43; Thomson, *Through Masai Land*, 166, 368-69, 379-81, 443; Johnston, *Kilimanjaro Expedition*, 438; Dawson, *James Hannington*, p. 366; Krapf, *Travels in East Africa*, 211, 279.

<sup>28</sup> Stigand, *Land of Zinj*, 237.

<sup>29</sup> St. John, *Life in the Forests of the Far East*, I, 148, 150.

ing or parting may be cited from the Boloki. When a son or daughter is about to travel for any reason, the father chews a certain shrub and spits on a leaf, mixing with it a little camwood powder. The wayfarer takes this mess with him and rubs a little of it on his body daily, to find favor and success wherever he travels. No son or daughter will venture to travel without this paternal blessing.<sup>30</sup>

Perhaps we should group with this reverential spitting the curious Tibetan salutation of thrusting out the tongue; the farther, the more polite or submissive the intention. If beaten in battle, the Tibetan will signify surrender by squatting down and hanging out his tongue; suggesting the behavior of a tired dog. I have seen no ventured explanation of the origin of this custom. But the dog is an ancient sacred animal with the Tibetans. They rejoice at the prospect of being eaten by one when they die and its own stuffed skin is hung up at a doorway or from the ceiling of a room, that its guardian spirit may continue to protect the family. It may be, then, that the hanging out the tongue was originally an imitation of the behavior of a tired or amicably disposed sacred dog. The point is not pressed.

### III.

The spitting of worship will be recognized as an inevitable consequence of this spitting of salutation. The gods or ancestors will secure the same marks of respect that are shown to men. The very word "spitting" may be used to express "worship," as among the Balubale, where *kupara*, "worship," is literally "spitting" or "spouting," and the name emphasizes the spirting of herb juice, holy water, or consecrated beer upon the ground, upon all present, and upon the ancestral bones to revive and invigorate the patron ancestral spirits. All present drink after this

<sup>30</sup> Weeks, *Among Congo Cannibals*, 307.

solemn libation.<sup>31</sup> In West Africa a thin veneer of Mohammedanism has been spread over African paganism. The black Moslem may be seen greeting the autumnal new moon by spitting in his hand and waving it three times around his head,<sup>32</sup> a custom really identical with kissing the hand to the new moon, condemned in Job xxxi. 26-28, or the Fijian custom of tapping the mouth with the hand when first seeing the new moon.

This form of salutation of the moon is still known in witch lore in Italy. Leland cites a spell in his *Aradia* (p. 44):

".....But I drinking  
In this horn, and drinking the blood,  
The blood of Diana with her aid,  
My hand to the new moon I kiss  
That she may guard my grapes  
At the moment the bud is formed,  
At the time of the grapes growing,  
And at last at the gathering, etc., etc."

In South Africa the same form of worship may be found. The Ama-Zulu, or "Celestial People" celebrate annually in the month of January the festival of first fruits. As the chief comes forth from his dwelling at the moment of sunrise, he spits at the sun three or four times.<sup>33</sup> This was thought by the French missionary Arbousset to be intended as an insult, African customs being new to him. Livingstone<sup>34</sup> is to be credited with a like error. He tells us that the Bakwains on seeing a crocodile at once spit on the ground, saying "There is sin."

The error here is doubtless one of translation. Livingstone labored among the Bakwains, or Ba-quaina, "people of the crocodile" whose totem, or *siboko*, is the crocodile, and knew their superstitious regard for it. The

<sup>31</sup> Crawford, *Thinking Black*, 260.

<sup>32</sup> Reade, *Savage Africa*, 355.

<sup>33</sup> Arbousset, *Exploratory Tour*, 232.

<sup>34</sup> *Travels and Researches in South Africa*, 277.

word he translated "sin" was probably more nearly expressible by "tabu." The spitting was undoubtedly reverential, as it is with South African totem clans generally. We may compare the superstition still found in Yorkshire that when you meet a white horse you must spit, or ill luck will befall you.<sup>35</sup>

The horse cult of the ancient Teutons, "lords of the white horse" as Tennyson calls them, is familiar to scholars, and this Yorkshire practice may be a survival of an ancient form of obeisance or salutation.

Returning to Africa, the Baperi, who reverence and swear by the porcupine, are grieved if any one kills or maltreats the animal. They then collect its quills, spit upon them, rub their eye-brows with them, and lament: "They have slain our brother, our master, one of ours, him whom we sing."<sup>36</sup>

So among the Damara, or Ova-Herrero, whose primitive fire-cult is less obscured by change than that of most African tribes, a hunter never returns from a successful hunt without filling his mouth with water and spitting it at the ancestral fire, as well as three times over his own feet.<sup>37</sup> It is probably a simple obeisance or libation. Among the Lighoyas and other Basuto tribes, there is much fear of the lightning, and a marked effort to control clouds and storms through the *morimo*, or ancestral spirits. At a sharp unexpected clap of thunder, one of a frightened group may ask his fellows: "Is there any one here who devours the wealth of others?" All then spit upon the ground, saying "We do not devour the wealth of others."<sup>38</sup> The formal spitting strengthens the solemn asseveration; as in covenant making, it seems equivalent to an oath. The American negro voodooist still superstitiously regards the

<sup>35</sup> Henderson, *Folk Lore of the Northern Counties*, 116.

<sup>36</sup> Arbousset, *op. cit.*, 257.

<sup>37</sup> Anderson, *Lake Ngami*, 221.

<sup>38</sup> Arbousset, *op. cit.*, 323.

behavior of the fire on his hearth; and if it snaps, sparkles, or gives out other evil omens he promptly spits in it,<sup>39</sup> which may be compared with the Damara fire-cult above cited.

This cultus-spitting must include the world-wide custom of spitting on a stick or stone which one deposits upon an ancestral cairn. It is a familiar fact that these are often only cenotaphs, or wayside erections for any wandering spirits—the original form of the crosses and chapels at European roadsides. All over South Africa they may be seen—piles of brush, poles, or stones, within a few feet of the wayside. Every passer adds a stone or green branch, which he devoutly spits on, and prays for prosperity in his journey. Neglect of these *issivivani* is sure to entail misfortune,<sup>40</sup> and the average Kaffir will spit on a stone and throw one into every stream he crosses as an offering to the water spirits. He will spirt a mouthful of water in the direction of his greatest enemy, or of any kraal where he suspects magic is being used against him. He chews medicines on various occasions, and spits in the same way, to avert mischief. A wounded warrior may go through a purification ceremony, part of which is spitting upon sticks, pointing at the enemy, and then throwing the sticks in that direction. Comparing this with the spitting upon a stick and placing it with a prayer upon the *issivivane* heap, it would appear to be an offering to the protective ancestor spirit of every Kaffir, accompanied with a prayer for vengeance upon his enemy. Mr. Kidd's theory that an explosion of contempt is at the bottom of all spitting rites does not fairly explain the data already cited.

The dead often appear to the Zulu in dreams, and such dreams are thought likely to make him ill. In that case the

<sup>39</sup> Leland, *Etruscan Roman Remains*, 318 note.

<sup>40</sup> Kay, *Travels and Researches in Caffraria*, 186-7; Callaway, *op. cit.*, 435; Kidd, *Savage Childhood*, 16; *The Essential Kaffir*, 9, 10, 308-10.

patient must take herbs prescribed by the doctor, and if the dream comes again he must chew them, spit the juice on a piece of firewood, or a stone, and throw them over his shoulder not looking back. This seems again the *issivivani* custom, an offering to the shade, respectfully avoiding the sight of it. Or the person tormented with such dreams may chew the prescribed herbs and deposit the spittle and stone in a hole he has dug in some remote place. The dream supposedly will not return.<sup>41</sup>

When such minor offerings are not accepted, the patient may be compelled to kill an ox for the ancestral shades. It is to be understood that the stone is a "dummy" offering, in lieu of a real or more substantial one, just as the Moslem may use dust or sand in place of water in his ablutions—a substitution known also in early Christian baptismal rites, when water was scarce. In precisely similar cairn ceremonies the Tibetan to-day will offer a stone when he has no sheep's head, and a handful of dust in place of a libation of wine.<sup>42</sup> That the ghost demanding bread was usually satisfied with a stone was doubtless in mind in Matt. vii. 9, perhaps also in iv. 3. When the New Caledonians lack fish for offerings they will use sacred stones instead, laying them before the ancestral skulls, chewing leaves, and spitting on the stones, saying "Help us to be lucky at our fishing."<sup>43</sup> The spitting upon such dummy offerings, however, might possibly be classified under the first division of this paper, as infusing a spirit or *anima* into any object by spitting on it. The Kaffirs when sacrificing an ox to ancestral spirits shut the meat up in a hut all night, that the shades may "lick" the meat, absorbing its "spirit" so; the earthly family then eat the meat the next day. A similar view of

<sup>41</sup> Callaway, *op. cit.*, 66, 160, 316-317, 435.

<sup>42</sup> Sarat Chandra Das, *Journey to Lhasa*, 190.

<sup>43</sup> Frazer, *Magic Art*, I, 163.

the gods or ancestral shades as "spirit eaters" is familiar in Polynesia.<sup>44</sup>

## IV.

More familiar to the general reader is the belief in the healing power of spittle. Primitive man could not fail to observe that an injured wild beast was apt to lick its wounds, and the notion of healing was promptly associated with this habit. So in the famous parable of Dives and Lazarus the oriental beggar, lacking better treatment, allowed the dogs to lick his sores, partly perhaps because of the semi-sacred character attaching to the dog in the ancient world. That wounds in the mouth heal much more quickly than elsewhere, has not escaped the attention of the Oriental enthusiast, and the fact is directly attributed to the saliva. Mr. Oliphant, watching dervishes run skewers through the cheeks without effusion of blood and with only a slight scar, sought for an explanation, and was told that it was due to the healing power of saliva and to the chewing of certain herbs, probably styptic. After making due allowance for all impostures the fact remains that mouth-injuries are in special favor with such enthusiasts.<sup>45</sup> In medical journals I have seen the suggestion that the presence of some beneficial microbes may explain the rapid healing of injuries to the mouth.

But animals do not merely lick; some have the trick of spitting at a wound. Crawford observes that the baboon, familiar all over Africa, will spit on the wound of a companion and rub it with a bit of bark. Livingstone observed similar behavior on the part of the soko in the grassy plains of the Manyema country, staunching the flow of blood with leaves.<sup>46</sup> The baboon's renown as a rain maker or

<sup>44</sup> Ellis, *Polynesian Researches*, I, 302-3.

<sup>45</sup> *The Land of Gilead*, 350-355.

<sup>46</sup> *Thinking Black*, 143; *Last Journals*, 325.



finder of water in time of drought has been already mentioned; adding this curious behavior, the animal's repute all over Africa as a physician or wizard of vast powers is easily understood. The possession of a baboon skin is in consequence a *sine qua non* with some would-be healers. That spitting should become a chief feature of the savage's healing of a wound, as with the Bushman,<sup>47</sup> is not surprising; and it is just as natural that especial value should attach to the spitting of men of supposed exceptional powers. So Mohammed in his healing, according to Ayesha, habitually used clay made with spittle,<sup>48</sup> and in Palestine the healing of wounds, burns, diseased feet, and serpent bites by the spittle of dervishes, maniacs, epileptics, and other holy men is a matter of every day occurrence.<sup>49</sup> Vespasian at Alexandria was besought to touch the blind with his spittle, and the lame with his foot, and by the aid of Jupiter Serapis, both were cured; so Tacitus and Suetonius tell us. The spitting upon the eyes of a blind man and anointing with clay, is familiar to every reader of the New Testament (Mark viii. 23, John ix. 6). Of the Arabian desert, Doughty reports, "A young mother, yet a slender girl, brought her wretched babe and bade me spit on the child's sore eyes; this ancient Semitic opinion and custom I have afterwards found wherever I came in Arabia. Her gossips followed, to make this request with her, and when I blamed their superstition, they answered simply that such was the custom here from time out of mind. Meteyr nomads have brought me, some of them bread and some of them salt, that I should spit in it for their sick friends. Also the Arabians will spit upon a lock which cannot easily be opened. "They also spit on, or at, malicious *jan*, or spirits; and a father will often say to his infant in arms,

<sup>47</sup> Chapman, *op. cit.*, 160.

<sup>48</sup> Hughes, *Dictionary of Islam*, 658.

<sup>49</sup> Bliss, *op. cit.*, 265-271; Grant, *The Peasantry of Palestine*, 94.

"Spit upon *bàbu*—spit, my darling!"—involving the notion of blessing or favor so familiar in Africa.<sup>50</sup> William Hayes Ward was appealed to for aid for a sick child, on the lower Euphrates. In the opinion of the Sheikh who so appealed, his task was not complete till he spit upon the child.<sup>51</sup> The North African nomad holds like views; spit in a child's face, and the parents esteem it a great favor;<sup>52</sup> and similar opinions survive in the folklore of Europe.<sup>53</sup>

All the practices we have noted are equally familiar in North America. Spirits of the dead make men ill by spitting or blowing in their faces; and the *shaman* would cure them by the same process.

Huichol worshipers purifying themselves before Grandfather Fire hold out their palms to him, then spit on them and rub quickly over their joints, legs and shoulders. Shamans follow the same method in healing. If deer hairs, foretoking success in the hunt, are found in the grass gathered for thatching the fire-temple, the shaman graciously spits on them before returning them to the lucky finder. When straw effigies of opossums are placed on the conical roof as guardians of the temple, the shaman and his assistant spit on them repeatedly and prayerfully. When placing a "prayer stone" on a wayside cairn to gain new strength for the journey, the person placing it first spits on it. When some one has been made sick through witchcraft, the doctor finds out the sorcerer and comes to terms with him, and the sorcerer makes himself invisible and goes to the patient and rubs spittle in the armpit, thus curing him.<sup>54</sup>

In Europe also, survivals of various uses of spittle in

<sup>50</sup> *Arabia Deserta*, I, 527; II, 164.

<sup>51</sup> Peters, *Nippur*, I, 350.

<sup>52</sup> Hesse-Wartegg, *Tunis*, 253.

<sup>53</sup> *Folktales of the Magyars*, LXV.

<sup>54</sup> Lumholtz, *Unknown Mexico*, I, 381; II, 40, 41, 239, 265, 267, 282, 354.

healing are known. Black<sup>55</sup> cites its usefulness against the evil eye, as a cure for warts, as an ingredient of salves, as part of the cure for gout or rheumatism, for healing sore eyes, and as an agency for killing scorpions among various peoples—some of these prescriptions being with incantations and some without.

## V.

Adding to this widespread primitive reverential spitting and its use in healing, the equally wide-spread theory of disease, and we have the key to the notion of contempt associated with spitting among more advanced peoples. Since all disease is caused by evil spirits the healing by spittle is directly a rite of exorcism, and where mystic spells are read for the purpose of healing they may alternate with spitting.<sup>56</sup> So in China spitting on the sick, on those in a swoon or mad, is an excellent way to expel the obsessing spirit or indwelling specter. Or the performer may blow upon them, or spirt water upon them, preferably in the face.<sup>57</sup> Slatin Pasha<sup>58</sup> tells how a Bornu doctor undertook to cure his headache by pressing the temples with thumb and forefinger, muttering pious texts and spitting in Slatin's face, getting knocked down for his pains by the unappreciative patient who could not understand that the disease was the work of the devil who must be driven out by spitting. Thompson reports a rite of exorcism witnessed at Mosul: a knife was laid on the patient's head, dates were brought in and fumigated with incense during the incantations, the magician then spit upon them and gave them to the patient to eat.<sup>59</sup> This was probably sending into the man a more powerful spirit to expel the mischievous intruder.

<sup>55</sup> *Folk Medicine*, 184-5.

<sup>56</sup> Doughty, *op. cit.*, I, 314.

<sup>57</sup> De Groot, *Religion of the Chinese*, 54.

<sup>58</sup> *Fire and Sword in the Soudan*, 25.

<sup>59</sup> *Semitic Magic*, 107.

Spitting at a passing jinn, or at an obstinate lock, already mentioned, may be compared with the Danakil belief. A camel having gotten loose in the night, the Danakil owner concluded that the devil was in the cord with which the animal had been tied. So the cord was rolled in the hands while spells were muttered, and the cord was spit upon at the close of each spell. The devil having unquestionably been expelled, the cord was delivered to a lad to seek and bring back the lost camel.<sup>60</sup> But the European unbeliever is sure to suffer many things among people who hate the devil so heartily. Mrs. Stevens tells us that a devout Soudanese Mohammedan, compelled by the infidel Frank to cook swine's flesh, was discovered devoutly spitting upon the accursed ham, before bringing it in to breakfast.<sup>61</sup> In the same kitchen a cook who sometimes frothed at the mouth was so completely under the control of a demon that his frightened fellows unskilled in exorcism dared not enter the kitchen, but stood outside till he handed them the finished dishes.<sup>62</sup> More fear and less esteem of spirit obsession is apparent here than in Palestine or Arabia.

In the same class with exorcism of evil agencies by spitting is the destruction of them by the same means. Folk-tales abound in such instances. In Japan we find the legend that when the great teacher Kobo Daishi was attacked by a dragon, he spat upon it and killed it.<sup>63</sup> In Morocco "not long ago, when swarms of locusts ravaged the gardens of Tangiers, the shereef of Wazam expelled the intruders by spitting in the mouth of one of them."<sup>64</sup>

But where the notion of healing by spitting becomes dominant, and the spitting salutation yields to other conventions or is slightly modified, the formal spitting upon

<sup>60</sup> Harris, *Highlands of Ethiopia*, I, 247.

<sup>61</sup> *My Soudan Year*, 29.

<sup>62</sup> *Ibid.*, 31.

<sup>63</sup> Lloyd, *The Creed of Half Japan*, 245.

<sup>64</sup> Westermarck, *Origin and Development of Moral Ideas*, 255.

a healthy person comes to be construed as an accusation of secret illness, sorcery or demon possession, and as such is promptly resented. It is familiar in Africa that a "witch doctor" makes his accusation often at the peril of his own life and must immediately flee from the fury of the accused party and his family. This is characteristic of only the more advanced stages of culture, however. The universal prejudice against an alien or stranger, or one of another cultus, makes all such to be construed as unclean, spirit-possessed persons, and prophylactic spitting and muttering of prayers, curses, or spells, is resorted to by those who think themselves in peril.

Thus in New Guinea certain tribes disinfect a party of suspicious strangers by whispering or muttering an incantation over the branch of a tree, striking each visitor on the back with it and spitting upon him, then burying the branch.<sup>65</sup> The rite naturally becomes associated with the feelings of the spitter, and the supposed uncleanness or inferiority of the person spit at. This explains the curious mingling of customs in Semitic lands, for instance. In Is. 1. 6 the exiled servant of Yahveh says he "hid not his face from shame and spitting," yet in Babylonia, as already cited, the priestly exorcist acquired his powers by having his own mouth spit into. So in Numbers xii. 14, Miriam is spoken of as liable to be thrust out of camp seven days if her father had spit in her face; but this probably does not mean that she is defiled by such spitting, but that such spitting is an announcement that she is defiled or obsessed by some spirit, the spitting being part of the exorcising rite. So also the *levir* who fails in duty is probably defiled thereby. Does the injured party cleanse him? (Deut. xxv. 9).

The mixed association remains to this day throughout all Semitic peoples, as already shown. One may spit at

<sup>65</sup> Frazer, *Taboos and Perils of the Soul*, 109.

a Frank as a mark of horror, fear, or contempt, or he may bring his child and request the Frank to spit upon it. All depends upon the personal estimate of the Frank prevailing at the time. The protective powers of spittle are the same in either case. Quite curious to us seems the fact that the familiar institution of *dakhil* or "taking refuge" with a powerful protector may take the form of spitting upon him, if he pass near enough to the suppliant.<sup>66</sup> It was probably a formal blessing or solemn adjuration of primitive times, to which the party appealed to dared not be indifferent. The same institution is found in Central Africa. Among the Bambarra a condemned criminal is safe if he can spit upon a passing chieftain, and the latter must thereafter support him as well.<sup>67</sup>

## VI.

That attention should be given to the probably ceremonial cleanliness of the person spitting is a clear and logical inference from the data cited. This is true in the Old Testament. There is no Levitical regulation against spitting in general, nor any intimation that all spittle is unclean, but an unclean person cannot spit upon a clean one without rendering him unclean (Lev. xv. 8). His spittle is temporarily impure. Catarrhal spittle is widely deemed unclean. The Babylonian priestly exorcist already cited claims that it is the "pure" spittle of Ea that has inspired him. Gudea, in one of his inscriptions, says that in his religious purifications he gathered up the impure spittle from the streets. A modern board of health would gladly give him employment. In a curative incantation over a dough figure, a Babylonian exorcist says,

"That the spittle which has been spat  
May be poured forth like water,

<sup>66</sup> Layard, *Discoveries in the Ruins of Nineveh and Babylon*, 317.

<sup>67</sup> Westermarck, *Op. cit.*, II, 637.

That the magic (?) which mingled with the spat forth spittle  
May be turned back."<sup>68</sup>

This may possibly mean that the evil effects of the spittle that wrought the mischief were due to its impurity; but it can not be certainly maintained. Shylock says to Antonio, "You did void your rheum upon my beard"; suggesting that Shakespeare knew the peculiar uncleanness of catarrhal spittle. Marcellus gives a cure for sore eyes, in which the mere spitting has acquired special precautions. Take the saliva of a woman who has born only male children, and has abstained from cohabitation and pungent foods three days. Then, if her spittle is bright and clear (not catarrhal) anoint the diseased eyes with it, and they will be cured. In modern Italy you must take the saliva and some of the milk of a woman who has born a seven-months child and anoint the sore eyes with the mixture, make the sign of the cross on the eyes, then spit thrice behind you, repeating a certain formula as you anoint. This must be repeated three mornings fasting. Again in a cure for gout, given by Marcellus, it is said "Poison is conquered by poison; fasting spittle can not be conquered." The healer must say this thrice, and spit each time on the soles or footprints of him who is to be cured. The spittle of a boy baby is in another formula prescribed as sure to be clean and pure, and it is used in the same way.<sup>69</sup>

#### VII.

It will be recognized that it is not possible in considering the mass of surviving spitting rites to point out unerringly the exact stage of thought or custom in which a given ceremony arose. For instance, cases already cited of spitting in connection with a prayer or desire to be avenged on one's enemy are slightly different from the

<sup>68</sup> Thompson, *The Devils and Evil Spirits of Babylonia*, 108.

<sup>69</sup> Leland, *Etruscan-Roman Remains*, 279-80; 296-97.



spitting of exorcism at a suspicious stranger. The first may be a primitive form of worship of a higher power, while invoking aid; the second may be only reliance upon some supposed mysterious powers of the saliva. Yet either may explain the custom of spitting on hearing the mention of a name or a deed of ill omen. In Scotland, for instance, some family names are names to spit at, and quite frequently it does not imply clan feud or personal hatred.<sup>70</sup> An Australian black may spit excitedly, if he learns he has inadvertently mentioned the name of a dead person; an Abyssinian may strive to spit and scrape off his tongue an oath he wished to abjure; and I have known an English miner to spit excitedly at unwelcome news or names. With the spitting of imprecation would be classed the Ovambo habit of cursing or bewitching an absent one by gazing at a pool of water (crystal-gazing) until the form of the man appears—then spitting at it and pronouncing the curse.<sup>71</sup> The other African data suggest that the spitting here is an invocation or obeisance to the patron ancestor. Invocation of a primitive earth-mother appears in some African religious rites and folk-lore, so that the belief that a rain-maker can raise a storm by spitting on the ground<sup>72</sup> would appear to belong to that type.

Exorcism again is suggested by the Atlas Berber who spat upon the coin Professor Westermarck gave him, to counteract the effect of any evil magic that might be in the Frank's coin.<sup>73</sup> But in northern Europe the fear of ill luck or misfortune takes the particular form of fear of losing that coin. So in northern England any money supposed to be received from a witch must be put into the mouth, or else the witch may spirit it away, and leave only a stone in its place. Another form of statement is that if

<sup>70</sup> *Folk-Lore*, VI, 170.

<sup>72</sup> Callaway, *op. cit.*, 409.

<sup>71</sup> Frazer, *Magic Art*, 163.

<sup>73</sup> Westermarck, *op. cit.*, I, 594.

you spit on the first money you receive in your day's trading, you will be lucky in the day's business.<sup>74</sup>

This notion that productive power is imparted by spittle has an amusing illustration in Mr. Thomson's experience in Masai Land.<sup>75</sup> The natives were greatly impressed with the strange white man and his powers, and at length an elderly important fellow came with his young wife and stated that they had decided that it would be a fine thing to have a little white boy of their own. Thomson argued that it was best to leave such things to Ngai (god, or patron ancestor). But they made it plain that they had much more confidence in him than in Ngai. Thomson got out of his difficulty by administering a magic potion, effervescing fruit salt, and spitting liberally all over the would-be mother. His friendship being demonstrated in orthodox Masai fashion, his fame spread, and his spitting powers were sorely taxed during the remainder of his stay in the land.

Creative power turns up in some later myths and folklore; as in India, for example. Agni, the fire-god, is said to have tried to conceal himself in the waters. Failing in this, he spat upon them, and three divinities sprang forth. Another legend of Tvashtri, the creator of seed, declares that he spat upon the head of a sacrificial victim, and that his spittle became the brain, and the marrow of the neck-bone, which some Hindu theories identify with the soul or spirit.<sup>76</sup> It would appear that in ancient India, as in modern Africa, spitting on the head of a sacrificial victim was a familiar custom.

From some of the data considered, the question is fairly raised whether spitting salutations are not the ancestor of kissing. This latter custom is far from universal. It is

<sup>74</sup> Henderson, *op. cit.*, 32, 181.

<sup>75</sup> *Through Masai Land*, 288-290.

<sup>76</sup> *Sacred Books of the East*, XII, 47; XXVI, 266.

<sup>77</sup> *Savage Africa*, 163.

not an African custom, where spitting salutations are prevalent and protruding lip and nose rings common. Reade tells us an amusing story of a negro princess's fright at being kissed the first time. She imagined this strange wetting with the lips was preparatory to devouring her.<sup>77</sup> East African pledges of friendship or brotherhood we have seen may take the form of spitting in each other's mouths, while a "holy" Arab may spit in the mouth of a neophyte, which custom reappears in some old rituals in the Christian church as kissing the neophyte. A friend who has taken part in American Indian dances tells me of some in which the dancers are paired, each carrying a pebble in the mouth which at a given stage of the dance the partners exchange. The spectators would call it kissing, though the red man as a race is not a kissing animal. In the salutations of the moon, previously mentioned, spitting in the hand and waving at the moon seems identical with kissing the hand to the moon; or, as I have seen spitting over the right shoulder on seeing the new moon. So the kissing of "peace" between two Arabs who meet may be the direct descendant of the exchange of spittle between two covenanting savages. Animals may have taught man something worth while, though the process was a long one!

Another by-form of this primitive salutation and mode of healing probably exists in the world-wide practice of shamans and magicians of "sucking out" a disease, exhibiting then some object as proof of their powers. To the primitive patient the power of a holy man's spittle is irrefutably demonstrated by such tricks. The American boy is not the first who has spit upon his bait in hopes of piscatorial success, and the modern mother who says to her child "Let me kiss it to make it well" has at least the authority of an immemorial past for her proposal.

## THE CHEMICAL ORIGIN AND REGULATION OF LIFE.

### INTRODUCTORY.

THE last years of the nineteenth and the first of the twentieth century, which have constituted a period of tremendous progress in physical science, have unfortunately witnessed a recrudescence of that "cult of incompetence" in biology, *vitalism*. Neo-vitalism, under the leadership of Driesch<sup>1</sup> in Germany and of Bergson<sup>2</sup> in France, asserts that the phenomena of life are not determined by law-abiding forces, but by a form of activity the effects of which are unpredictable, and which, consequently, must be regarded from a formal point of view as chaotic and beyond the range of science.

It is the purpose of the present paper to combat the thesis of the new vitalism by showing how a single physico-chemical conception may be employed in the rational explanation of the very life-phenomena which the neo-vitalists regard as inexplicable on any but mystical grounds. This conception is that of the *enzyme*, or *organic catalyst*, and it is the belief of the writer that the conception in question, with its physical and chemical corollaries, will ultimately prove adequate to the resolution of at least five fundamental mysteries of vital behavior: (1) the origin of living

<sup>1</sup>Hans Driesch, *The Science and Philosophy of the Organism*, 1908, 2 vols. Also, *Die "Seele" als elementarer Naturfaktor*, 1903.

<sup>2</sup>H. Bergson, (Engl. trans.) *Creative Evolution*, 1911.

matter, (2) the origin of organic variations, (3) the ground of heredity, (4) the mechanism of individual development, and (5) the basis of physiological regulation in the mature organism. It is perhaps needless to say, however, that only a very meager idea of the manner in which the enzyme concept can be applied in the solution of these problems can be conveyed within the limits of a single article, and, accordingly, the writer hardly expects to satisfy all of the demands and arguments of neo-vitalism in the present paper. It must suffice here to suggest lines of thought which may later be developed more extensively.

A word should be said at the outset concerning the method and point of view of the discussion which is to follow. This discussion will present no new experimental facts; it will rather compare and unite a number of such facts, which are common knowledge to all biologists, in an attempt to build up a consistent and coherent theory of the experimental field in question. Our method, then, will be *synthetic*, or inductive in the true sense of the word, instead of being strictly empirical. Very few theories can be directly verified by the observation of nature; the best one can say for a scientific hypothesis is that it is in harmony with the facts, and this harmony is what constitutes explanatory power. That the theory of enzymes is in harmony both with the phenomena exhibited by living organisms and with the principles of chemistry and physics we shall attempt to demonstrate, so far as is possible within the limits of a brief discussion; but we cannot hope to show that it is an accurate representation of reality, for this is too much to ask of any scientific theory. The only original merit which the writer cares to claim is that of seeing and recording the perfectly obvious relationships of things, when his colleagues have failed to see or else to record them.

## THE ENZYME AS A CHEMICAL REGULATOR.

Modern vitalism, like its progenitors, is dualistic. It asserts that living matter is the product and expression of two fundamentally independent forms of existence, the physical and the vital. And the first difficulty which vitalism raises in the path of scientific progress in the study of life is that of the process by which protoplasm was first generated from inorganic substances. Under present conditions living matter is formed from the non-living only under the influence of other living matter; but if the mechanistic theory of life is to hold we must suppose that this has not always been the case and that far back in the past there was a time when organic bodies were formed spontaneously from dead and unorganized matter. The vitalist maintains that such a spontaneous change is inconceivable and that in order to account for the origin of living organisms one must invoke the activity of a special *regulative principle*, which even in the first instance limits and directs the mutations of physical substance so that vital phenomena at last appear. But the objections which can be made to the physico-chemical interpretation of life do not end at the beginning; simple protoplasm must be developed into complex and varied organisms, each capable not only of propagating its kind but also of giving rise to new species which shall constitute improvements upon the old.

Neo-vitalism tends for at least two reasons to reject the Darwinian doctrine of evolution by natural selection, which was formerly considered adequate to the explanation of tribal development. The first is the admitted failure of the mechanistic school of biologists to account for the *origin of variations*. Darwin referred to variations—which form the *sine qua non* of natural selection—as accidental, but qualified this reference by stating that he did

not actually regard them as accidental but as due to unknown causes.<sup>8</sup> The modern vitalist emphasizes the unfortunate fact that these causes are still unknown. The second reason which neo-vitalism advances for its rejection of the Darwinian theory lies in the alleged fact of the *purposeful character of variations*: it is asserted that the changes which take place in the propagation of a species are not haphazard in distribution but manifest a definite teleological trend. This, say the vitalists, is due to the regulative influence of the vital force, which is also the cause of variation in general.

Mechanism in biology not only fails, in the mind of the vitalist, to account for organic variations, but it also fails, curiously enough, to explain the facts of heredity; it is inconceivable that the tiny germ-cell should contain a physical machine which shall be capable of constructing the living organism with the wonderful accuracy which is actually manifested in embryonic development. The organism is too intricate, and the raw material too indifferent to permit one to refer the elaborate processes of ontogeny to a mechanical contrivance contained within the germ; the relationship of heredity can only be accounted for by calling in a special vital principle which here, as in the pristine beginnings of life, serves to regulate the physical and chemical forces which impinge upon the germ-cell, and which thus engineers the changes by which the mature organism is built up. The necessity of postulating such a regulative force, outside of those of ordinary matter, is proven not only by the remarkable uniformities which are observable in the structure of individuals of the same species, but also by the ease—one might almost say the dexterity—with which the constructive process overcomes obstacles which are placed in its way. Cut a partly developed embryo in two and it will still produce a perfect organism. Purpose-

<sup>8</sup> C. R. Darwin, *The Origin of Species*, 1859, Chap. 5, pp. 131-171.



ful adaptability of this sort can hardly be consistent with the mechanical regulation of development, but it is quite conceivable in connection with the operation of a semi-conscious vital energy which possesses properties resembling foresight and calculation.

Difficulties of a similar nature are raised by vitalism against the physico-chemical theory on the basis of normal physiology, in which there exist many cases of special organic regulation which are asserted to be inexplicable as the effects of mechanical forces acting under purely mechanical conditions. Such functions as the "regeneration of lost parts" and the general phenomena of "animal behavior" are said to demand a non-mechanical explanation. They present a type of regulation foreign to that exhibited by any physical substance.

It would seem, then, from the above review of the objections which the neo-vitalist raises against our acceptance of the physico-chemical theory of life, that these objections may be reduced to the problem of discovering a physical or chemical conception capable of accounting for the observed facts of organic regulation. Regulation seems to be the most striking active characteristic of living beings. The word "regulation" is here employed to denote the power which is shown by organisms to reach their apparent ends more or less independently of the environment in which they are placed, in fine, their capacity to neglect or leap over the difficulties which may be thrust in their way.

The necessity for such regulation first appears in connection with the problem of the origin of life. In order that the multitudinous and chaotic chemical changes taking place in the primeval oceans should have resulted in the production of definitely localizable and individual masses of even simple protoplasm, there must have appeared some regulative force which could limit or encourage these reactions in special directions, and which could maintain

the individuality of the protoplasmic masses throughout long periods of continuous growth and repeated subdivision. If this regulative principle were embodied in a definite chemical substance or substances we might expect that the accidents of the process of its reproduction would lead to disturbances of its original nature, and to the consequent appearance of variations in the constitution and functions of the living bodies whose characters it served to determine.

This failure of the regulative principle to act with complete perfection would bring into the field of the struggle for existence new forms of regulation, which, if they happened to mediate valuable structures or activities, would be preserved and become the basis for further and more elaborate differentiation by the same method. The sum of all of the regulative substances thus established within the organism would constitute the physical ground of heredity and of embryological development,—a relation and process which is *par excellence* regulative in nature,—and these same physical determinants, arriving finally by their own efforts at the stage of mature or adult organization, would be capable through their regulative capacity of superintending the normal activities and special adaptations of the fully developed living being. However, in this final stage of their function, as in the first, the material regulative principles must not be expected to remain entirely uninfluenced by the disturbing physical and chemical forces which are more or less accidentally brought to bear upon them in the course of their regulative activity. Hence it may be that some features in animal, or even in plant behavior will present that same aspect of variability which appeared in the case of primitive development, and throughout the evolutionary process.

Regulation is essentially a selective activity. Out of a multitude of possible chemical and physical reactions the

living organism selects only those limited few which correspond to what we call its "needs" or "purposes." Whether the meaning which we commonly attach to these words is at all significant from the point of view of science is a question, but whatever the case may be it is obvious that if we can exhibit a general and adequate chemical basis for such control we shall have smoothed out many of the difficulties which are faced by the mechanical theory of the nature and origin of living forms. This is the task which now lies before us.

The fact that all vital activity involves chemical change—and, if it is to be accounted for in naturalistic terms, must be supposed to derive all of its energy from such change—makes it necessary that we look for a *material principle of regulation having an essentially chemical nature and function*. Since it is our thesis that the enzyme constitutes such a principle, and one which if properly applied will dispell the fundamental difficulties raised by vitalism in the face of the physico-chemical theory of life, it becomes necessary that we devote a few words to the enzyme *per se*. The enzyme is an organic catalyst, and a catalyst is a substance which by its mere presence in a mixture is able to facilitate and direct the chemical changes there taking place. This directive power of a catalyst resides wholly in its singular ability to accelerate the so-called reaction velocity of specific chemical reactions.

It is a fact well known to students of chemistry that every such reaction possesses a characteristic "rate" which is constant for constant conditions of temperature, pressure, concentration, and the like. But all chemical changes appear to occur in the face of forces of resistance, which are at least comparable with friction in the case of mechanical motions, and the greater the chemical friction, the slower, of course, is the "rate" of the corresponding reaction. Now the mechanism by which catalyzers are able to accelerate

or hasten reaction rates consists apparently in a reduction of the chemical friction. The catalyzer is a sort of inter-molecular lubricant, which oils a specific reaction; it cannot assist the change by any energy of its own because it does no work, and remains unaltered at the end; rather, as the derivation of its name would indicate, it operates by freeing the molecules from their chemical chains and permitting the reaction to "slide." Every chemical change seeks a definite level; whether that level is found in a minute or in a century may be determined by the presence or absence of the appropriate catalyst.

Catalysis is not a mystical process. Although up to the present time no precise hypothesis has been advanced to elucidate its mechanism, this is due to lack of interest in the problem rather than to the impossibility of its solution, for the modern electrical theory of the constitution of matter suggests an explanation which is at once simple and in harmony with all existing physical and chemical principles.

The reduction of chemical friction by the presence of catalysts is so marked that reactions, such as that between cold oxygen and hydrogen, which without the catalyzer (platinum) would require thousands of years for their completion, may, with it, be finished in very short order. And to accomplish this catalytic lowering of the chemical resistance it is not necessary that very large amounts of the liberating substance be present; the effect—upon the decomposition of hydrogen peroxide—of finely divided platinum at a concentration of one part in three hundred million, is easily detectible. But small as is the quantity of catalyst which is thus effective, it could, theoretically, be entirely recovered from the solution at the end of the reaction, no matter how much peroxide had been decomposed or how long the reaction had been in process.

The relevancy of the peculiar properties of catalysts—

and in particular of enzymes—to the solution of the biological problems which we have been considering will appear more clearly as our discussion proceeds. It happens that chemical friction—which, we have said, is lowered by catalysts—is conspicuous in almost all reactions into which the compounds of carbon enter, and as everybody knows, it is carbon which constitutes the chemical basis of life. Accordingly, we should expect to find that the manifestly active nature of living beings is dependent upon catalytic processes, and this expectation is verified by empirical research. The presence of a specific catalyzer, or enzyme, in a complex solution of organic substances such as is given in protoplasm will obviously have the effect of accelerating that particular reaction with reference to which it is specific, while the other changes remain uninfluenced. When, as is the case with most organic reactions, the original changes are so slow in rate as to be practically negligible, and the specific acceleration produced by the enzyme is considerable, the effect of the latter will be to all intents and purposes the same as if it actually carried with it into the chemical arena, previously empty of change, a specific activity.

It is clear, then, how by their mere presence in complex mixtures, especially of organic compounds in solution, catalysts can exert a positive control over both the qualitative and quantitative nature of the chemical reactions which may occur in these mixtures. Since protoplasm is just such a solution as this, and since the fundamental changes taking place in living matter are chemical, the “regulative principle” which we have in our previous discussion found to be required by the most general facts of biology, may obviously be identified with the catalyst; and in this identification we shall provide a complete general basis for the explanation not only of the phenomena of regulation them-

selves, but of those deviations from regulation which appear in evolutionary and individual progress.

#### THE ENZYME AS THE CREATOR OF LIFE.

Extant theories with regard to the origin of life agree that the birthplace of living forms was the primordial ocean. In Paleozoic times the seas were universally warm, and were kept in this condition by the blanket of water-drenched air which sheathed the earth. The high concentration of carbonic acid existing in these early oceans was another factor which must have favored the original production of protoplasm, a substance fundamentally aqueous in its constitution and which even at the present time contains essentially the same variety and relative proportions of inorganic salts as are found in the sea. The idea that the primeval oceans were the cradle of life is not inconsistent with vitalism, for since life processes must have a physical substance, this substance might with all appropriateness be drawn from the warm waters of the early seas by the initial efforts of the vital force. It has been suggested, however, by Richter,<sup>4</sup> Arrhenius,<sup>5</sup> and others that the spores of life may have been transmitted to the earth within the cores of meteorites or under the pressure of starlight, an idea which enforces the conception of a permanent dualism between the living and the non-living. On the mechanistic side the theory has been advanced by Pflüger<sup>6</sup> that the first forms of living matter were based upon the compound cyanogen, but it is difficult to see how, upon Pflüger's hypothesis alone, this primitive protoplasm was able to reproduce and maintain itself when once formed, or how a sufficient

<sup>4</sup> H. E. Richter, "Zur Darwin'schen Lehre," Schmidt's *Jahrb. d. ges. Med.*, 1865, cxxvi, p. 243.—"Bericht über medicinische Meteorologie und Klimatologie," *ibid.*, 1870, cxlviii, p. 57.—"Die neueren Kenntnisse von den krankmachenden Schmarotzerpilzen," *ibid.*, 1871, cli, p. 313.

<sup>5</sup> S. Arrhenius, *Worlds in the Making*, 1908, Chap. viii, pp. 212-231.

<sup>6</sup> E. Pflüger, "Ueber die physiologische Verbrennung in den lebendigen Organismen," *Arch. f. d. ges. Physiol.*, 1875, X, p. 251.

amount of it to make up even a minute living body came to be produced at any one point.

It would be inconsistent with the general principles of evolutionary theory to suppose that protoplasm as we now know it came into being by any instantaneous process of creation; primitive living substance must have been something much more closely akin to ordinary inorganic matter than is protoplasm as we find it to-day. But primitive protoplasm must have possessed at least some of the characteristic vital properties; it must have been capable of growth and must have exhibited a certain selective activity with reference to its environment.

It is probable that the substances necessary for the original production and the nutrition of such a primordial life-form were present in the ocean-waters in rather high dilution, and there can be little doubt that the chemical changes which were requisite in order that these substances should be transformed into the native material of the organism itself were not such as could be counted upon to take place spontaneously with an appreciable rapidity. There is thus no guarantee that a rudimentary protoplasm, once formed, would exhibit the phenomenon of growth, except by virtue of some inherent properties of its own.

A little reflection will serve to show that if we are not diffident in our application of the conception of catalysis it will provide us with an explanation of life from the very start. Let us suppose that at a certain moment in earth-history, when the ocean waters are yet warm, there suddenly appears at a definite point within the oceanic body a small amount of a certain catalyzer or enzyme. Let us, moreover, imagine that the sea-water contains in solution a number of substances which react very slowly to produce an oily liquid, immiscible with water. A reaction of this character based upon probable solutes of the early seas might easily be specified. Now in the third place, we must



imagine that our enzyme is related with this reaction in such a way as greatly to reduce the chemical friction which it encounters, and hence markedly to increase its rate. What will be the outcome? Why, obviously the particle of enzyme will become enveloped in the oily material resulting from the reaction, and if it happens that the original substances which enter into combination are soluble in the oil as well as in the sea-water, the little oil drop will wax greater until it is split up into smaller globules by the natural currents of the ocean. It is clear that the developing oil drop is intended to represent the origin of the first and simplest life-substance. But protoplasm, however undifferentiated, must possess the power of indefinitely continued growth, a characteristic which is apparently lacking in our oil drop, for the reason that repeated sub-division will finally exhaust the original quantity of catalytic material which is present, and which is responsible for the growth process.

We have said that enzymes, and catalysts in general have the power to assist in the production of specific chemical substances. Now there is no reason why the same enzyme should not aid in the formation of more than one substance and also why one of these substances should not be identical with the enzyme itself. A process of the last mentioned variety, in which the presence of a catalyzer in a chemical mixture favors the production of the catalyzer itself is known as *autocatalysis*. Many instances of autocatalysis have been discovered in the field of inorganic chemistry so that it cannot be regarded as in any sense a vitalistic phenomenon, although we shall find the relationships which it involves to be indispensable in the chemical explanation of vital events. This will be made evident by the manner in which the conception of autocatalysis removes the difficulties faced by our theory of the origin of protoplasm. In order that the primitive life-substance,

whose original formation we have described above, should be capable of continuous growth in all of its sub-divisions it is only necessary that the enzyme about which it centers should be autocatalytic, as well as effective in the production of primitive protoplasm. In this case each new globule which is formed from the original one may carry away with it a quantity of enzyme sufficient to permit its continuous growth and reproduction.

The theory of the origin of life which we have briefly outlined above, and which is to be extended as our discussion proceeds, satisfies most of the objections which have been advanced against the ordinary chemical hypothesis. The characteristic catalytic power of the enzyme accounts for the elevation of the rate of the synthetic reaction from a practically null figure to one making possible rapid growth of the protoplasmic mass. The same catalytic property explains the localization of the reaction in a definite region, for catalysis can occur only where the catalyzer itself is present. The theory also provides a basis for the permanent growth of the primitive organism—if such we dare to call it—as well as for its reproduction, without, in general, the loss of its specific individuality.

The most fundamental objection which can be raised against the theory has reference to the source of the original enzyme. This enzyme is a very special sort of body, and consequently its fortuitous formation in the primeval oceans may be regarded as an improbable event. However, this is not equivalent to saying that it was an impossible occurrence, and since only one event of this specific kind is required by the theory during a period of time covering many millions of years, objections based upon general considerations of probability have practically no force. Chemistry must answer the question as to whether our first enzyme is possible. A very great number of different compounds must have been formed as a result of the multi-

tudinous chemical reactions which undoubtedly took place in the primordial oceans, and there is no reason why one of these compounds should not have been just the body required to mediate the origin of living matter. The striking fact that the enzymic theory of life's origin, as we have outlined it, necessitates the spontaneous production of only *a single molecule* of the original catalyst, renders the objection of improbability almost absurd.

Now although the primitive living bodies whose hypothetical origin we have above described possessed the characteristic vital power of propagating their kind by indefinitely repeated processes of subdivision, they cannot be regarded as living in the full sense in which this term is applied to the complex substance of animal and plant cells. Primitive protoplasm was probably an almost pure chemical compound; evolved protoplasm, on the other hand, is characterized by its very lack of chemical unity. Contemporary general biology is largely a development of the conception of "simple protoplasm." But "simple protoplasm" is not simple; it is a complex, a structure, a mixture; and if we are evolutionists we cannot admit that such a substance is the ultimate ground of biological thought. "Simple protoplasm" must have a chemical history, must have been built. In the following section of this article we shall consider the process by which in accordance with the theory of enzymes, primitive protoplasm may have developed into the more advanced type now familiar to biologists. It suffices at this point if we have shown that the regulative principle of life which vitalism asserts must have existed prior to all concrete vital phenomena was not necessarily immaterial in its substance. That control of self and of environment, which the vitalist rightly regards as its defining feature, appertains to life only by virtue of the store of *enzymes* which is hidden away in protoplasm, and when one of these enzymes first appeared, bare of all body,

in the aboriginal seas it followed as a consequence of its characteristic regulative nature that the phenomena of life came too.

#### THE ENZYME AS THE BASIS OF EVOLUTION.

In spite of the great prestige of the Darwinian theory of organic evolution, many neo-vitalists have not hesitated to assert that this theory will soon be regarded as a matter of historical interest only. The doctrine of the development of adaptive forms of life by accidental variation and natural selection—which was advocated by Darwin—seems to be the only conceivable hypothesis which is capable of explaining the origin of species in a mechanistic way, and yet it cannot be denied that this doctrine has recently met with reverses. The most important of these lies in the inability which is exhibited by its principal exponent, August Weismann,<sup>7</sup> to account in physical and chemical terms for the origin of variations. Darwin himself left this problem to be solved by his successors, with the single suggestion that variation might be due to an inheritance of acquired modifications. The mechanistic theory of heredity, as formulated by Weismann,<sup>8</sup> renders this suggestion abortive, and the alternatives of “amphimixis” and “germinal selection” which have been proposed seem upon analysis to be merely methods of begging the question. But there can be no doubt that variations do occur, and since no satisfactory physico-chemical explanation of their origin is forthcoming, the vitalist naturally propounds one which is in harmony with his own presuppositions, and then he proceeds to strengthen his vitalistic doctrine by showing that variations are in many cases distributed according to purpose rather than according to chance.

<sup>7</sup> A. Weismann, (Engl. trans.) *The Evolution Theory*, 1904, 2 vols.

<sup>8</sup> A. Weismann, (Engl. trans.) *The Germ Plasm*, 1893.

The so-called "orthogenists"<sup>9</sup> find a consistent teleological directioning of variation in the evidence both of paleontology and of the modern statistical study of the grounds of evolution, a discovery which is at least formally in agreement with the Lamarckian—and anti-mechanistic—principle of development through a more or less purposeful effort on the part of the individual organism. The De Vriesian "mutation theory"<sup>10</sup> is also taken by some vitalists to represent an anti-Darwinistic movement, and indeed in a certain sense this is true, but—as we shall endeavor to demonstrate—the mutation theory is not inconsistent with the mechanistic view of organic nature, and may even be considered more in harmony with modern physico-chemical ideas than is the original doctrine of Darwinism.

Neo-Darwinism—which to-day opposes the vitalistic view of evolution—insists upon the primary irrelevancy of the character of variations to the demands, purposes, or needs of the varying and developing organism, and maintains that the fact of adaptation is to be explained only by reference to the "survival of the fittest." All species are subject to repeated and excessive multiplication, the individual exemplars of the species exhibiting variations from the type which are due in all significant cases to "spontaneous" alterations in the constitution of the determining germ-plasm, and which, in general, possess no predominating tendency either to assist or to injure the welfare of the organism, if anything rather the latter than the former, since there are more unfavorable possibilities than there are favorable ones. Since the original variations occurred in the constitution of the germ, and only secondarily in that of the individual organism, there is every reason why they should be reproduced in the ensuing offspring of the same germinal material. Those organisms

<sup>9</sup> Cf. G. H. Th. Eimer, *Organische Evolution*, 1890; and E. D. Cope, *The Primary Factors of Organic Evolution*, 1896.

<sup>10</sup> H. De Vries, (Engl. trans.) *Species and Varieties*, 1905.

possessing germinally determined characters which unfit them for survival will perish, and with them the malforming germ-plasm, so that at any time in the history of living species there will be a great preponderance of adaptive over non-adaptive organic forms. This is the essence of the mechanistic theory of evolution, a theory the critical weakness of which lies in its failure to account for the origin of variations.

Probably the greater number of the modern objectors to Darwinism would admit the validity of the process of development which it represents, provided only it is legitimate to adopt three fundamental hypotheses: first, that the germ-plasm actually and inevitably determines individual characters; second, that spontaneous variations in the constitution of this germ-plasm do occur and thus necessitate parallel variations in the corresponding individuals; and, third, that these variations are of such an order of magnitude as to bring about considerable differences in the adaptation of the individuals in question to the conditions of life. The dispute concerning the validity of Darwinism rests, then, upon a disagreement with reference to the ground of heredity, and more especially with regard to the possible occurrence of large and frequent spontaneous changes in the exact character of this ground—if it be material—in particular cases of descent. In a word, the solution of the vitalistic difficulties in the field of evolutionary theory will be provided in *an intelligible physico-chemical hypothesis capable of explaining both Mendelian inheritance and De Vriesian mutations*. It is our thesis that the theory of enzymes meets the requirements of this situation.

Our theory of the beginnings of life, which we have outlined in the preceding section, demands that primitive protoplasm should be composed of a single chemical substance which can be formed from the reagents present in

the waters of the primeval oceans, by the intermediation of a specific *enzyme*, which latter is at the same time capable of bringing about its own reproduction by a similar, but *autocatalytic* process. The possibility and probability of the appearance in the early seas of an enzyme of this character have already been sufficiently debated. "Primitive protoplasm" was far from being what we now know as protoplasm, and which, as has been indicated, biologists often erroneously regard not only as the present but as the historical basis of life; irritability and contractility with all of their refinements and combinations are evolutionary additions to the original physiology of the vital material, due to variation and natural selection. If this is true, we may study this evolutionary process at its simplest in the development of "primitive protoplasm" into the more complex living substance which we now know. The original enzyme was the outcome of a chemical reaction, that is to say, it must have depended upon the collision and combination of separate atoms or molecules, and it is a fact well known among physicists and chemists that the occurrence and specific nature of such collisions can be predicted only by use of the so-called *laws of chance*. This does not mean that the motion of the molecules is actually at random, but only that the conditions which govern that motion are so complex and so difficult to study that we have as yet been unable to analyze them.

Now the kind of molecule—or chemical substance—which is produced by any particular molecular collision must depend upon the nature of the molecules which originally collide and upon the force and direction of the collision, and these factors, in turn, so far as we are concerned, are referable to chance. Consequently we are forced to say that the production of the original life enzyme was a chance event. But once a single molecule of this enzyme was formed its very existence *increased the probability*



that further molecules of the same sort would be produced in the same locality; this is the meaning of autocatalysis. The autocatalytic process thus established does not, however, preclude the occurrence of further chance events of the same general kind as the one which produced the first enzyme; indeed, on account of the increase in chemical activity which it occasions the presence of the catalyzer decidedly favors such further events. Accordingly we have only to wait a sufficiently long time, and a second autocatalytic enzyme will appear, and this enzyme may furnish the basis of a new species of regulation in the substance which we have called primitive protoplasm, and which it was the sole duty of the original enzyme to synthesize from the oceanic solutes. The chemical reactions which are set up in the primitive living substance by the appearance of the second enzyme may be either favorable or prejudicial to its continued existence. In the former case the enzyme and the function which it subserves will be preserved by the action of natural selection; in the latter it will be destroyed together with all of those species of primitive protoplasm which contain it. In either event it constitutes a new biological variation, which, if favorable, provides the foundation of a new protoplasmic species. It would appear, then, that the *theory of enzymes provides a molecular basis for organic variation*, and as our discussion progresses it will become clear that this explanation is profoundly in harmony with the facts of biology, as well as with those of physics and chemistry.

Biometry demonstrates that the variability of organisms of a single species follows, in general, the law of error, a fact which clearly suggests, if it does not prove, that the factor controlling biological variation is that of chance, or the independent causal activity of a large number of separate material units. That variations should obey the laws of probability, and these only, is to be expected if the

theory of enzymes is true, if the chances of variation are identical with those of the production, within the body of living matter, of special types of enzymic substance. Differentiation is simply the outcome of a continuation of the same process of random collision and combination which resulted in the production of the original life-forming enzyme. Since the *reproduction* of the germ-plasm is a chemical process, it can occur only by virtue of the probabilities involved in a *molecular chaos*.

The conception of the molecular chaos is one which is fundamental in modern physics and chemistry, and is based upon the idea that the heat motions of the individual particles which make up a body are relatively independent of each other both as regards direction and velocity. This implies that from the standpoint of the situation as a whole the molecules move more or less at random. Chemical reactions of any specified sort occur simply because the appropriate molecules happen to collide at the right speed, with the right side chains pointed in the right direction. If we take a large number of molecules we can be sure of a uniform result in any instance of chemical reaction. But if we consider a small number there will be certain cases in which the right molecules will not properly collide at all, other cases in which only a few appropriate collisions will occur, and still others in which all of the encounters will be favorable. Now the primitive germ-plasm—the first enzyme—and the elements of the later germ-plasms which arise under its influence, are not made up of an enormous number of molecules. The individual determining elements probably do not contain more than a few thousand molecules apiece. Hence it follows that the chances of the molecular chaos cannot be relied upon invariably to assist the controlling enzyme in its own reproduction, or autocatalysis.

Under these conditions there will of necessity creep

into the germ-substance aberrant molecular formations, the presence of which will produce organic variations. Some of these new conditions will simply be negative, a failure of the original autocatalysis. Others, however, will be positive, the chance occurrence of rare orientations of colliding molecules causing the original enzyme to aid in the construction of new catalytic bodies, which may then become parts of a more complex germ-plasm; no enzyme can be regarded as absolutely specific in its catalytic relationships. Again, new enzymic substances may arise by the same process which produced the original catalyst of "primitive protoplasm," the simple uncatalyzed but fortunate collision of certain molecules contained within the living material. It should be kept constantly in mind that in the case of the production or reproduction of an autocatalytic enzyme a single molecular instance may determine a far-reaching series of chemical events; for the formation of a single molecule of such a substance by a type of collision which is perhaps very rare, will mark the only necessary beginning for a continuous catalytic reproduction of this substance, and possibly of others, throughout a period of indefinite length.

It is important to notice that the basis of evolutionary change which is provided by the theory of enzymes is one which supports an increasing complexity of germinal and organic characters. The variations which occur in the original germ-plasm do not involve the substitution of new germinal or enzymic elements in place of those already present, but consist rather in the *addition* of these new elements to the original ones. If these additions prove to possess catalytic properties which assist the organism in its struggle for existence they will be preserved; if not they will be destroyed by natural selection. But if they are preserved they will furnish the basis of an *added character* of the protoplasm and organism, for the *original* catalytic

substance—being present in relatively large quantities, and so not liable to be disturbed by chance failures in the autocatalytic reaction—must also be preserved by the same selective forces; both the varied and its variation will exist alongside of each other. In this way, as time goes on, the organic forms which exist upon the earth will tend to become more and more complex.

Another consideration which is of the utmost importance, and which again reveals the powerful explanatory nature of the theory of enzymes, is that all variations of the sort which we have discussed above must be looked upon as "mutations" rather than as of the "quantitative" or "Darwinian" sort. Certain modern students of the phenomena of heredity, such as Professor Johannsen,<sup>11</sup> have compared organic species to chemical compounds, and in making this comparison have designated them as "bio-types." A "bio-type" seems to have the same individuality as has a specific chemical substance; different "bio-types" are separated from each other by definite qualitative intervals; in interbreeding they do not "mix" but maintain their identity, and if we are to accept the teachings of De Vries we must suppose that their origin is also characterized by discontinuous qualitative change, such as is involved in any chemical reaction. But surely this modern point of view with regard to the nature of variations—which has been made possible by the epoch-making discoveries recorded in "Mendelism"<sup>12</sup>—is unequivocally demanded by the theory of enzymes.

If we believe that the organs and functions of living creatures are determined in nature by the number and quality of the catalytic substances contained in the germ-cell, we must perforce hold that these organs and functions will vary in accordance with the changes which take place

<sup>11</sup> Johannsen, *Lowell Lectures*, 1912.

<sup>12</sup> See, for example, R. C. Punnett, *Mendelism*, 1911.

in this assemblage of enzymes. But since the enzymes are definite chemical compounds *all significant alterations* of this sort *must be qualitative and discontinuous*. It is not strange, then, that organic species should be readily comparable in their properties to the discrete bodies known to chemical science. The doctrine of De Vries that all effective biological variation consists in the addition or subtraction of Mendelian "unit characters" is quite unescapable in the theory of enzymes, for in that theory the "unit characters" correspond, as we shall see, to the individual enzymes of the germ-plasm. "Bio-types" are at bottom *zymo-types*.

The limits of this article are such as to render impossible a detailed description of the probable series of changes by which the mechanism of chemical variation which we have discussed above has been able, with the assistance of natural selection, to "evolve" living creatures as we now know them from the basis provided in "primitive protoplasm." The general principles which are involved are, however, clear. Each new enzyme which is generated within the life substance adds a new character. "Primitive protoplasm" possessed but one essentially vital property: the power of self-reproduction or growth. The other fundamental characteristics of developed protoplasm, irritability, contractility, and the destructive metabolism upon which they are based must be regarded as results of a long process of evolution. "Simple protoplasm," as we have insisted before, must have a complex chemical history. *There is practically no effect which is produced within living cells which cannot be referred to the presence of a suitable enzymic substance.* Divergence of characters among the many lines of descent leading from "primitive protoplasm" are, of course, to be expected, and variations in the type of metabolism which are selected in these di-

verging lines will lead ultimately to the foundation of two biological kingdoms: the animal and the vegetal.

In the beginning all living forms were, of course, of the single-celled or globule type. No difficulty exists in explaining the manner in which the chemical constitution of single cells could determine their cohesion into the large *cell masses* which make up the multicellular plants and animals, and the process by which the differentiated cells and cell-systems of these higher organisms are produced by the continued subdivision of an original germ-cell can also be explained in terms of enzymes. This is a subject to which we shall return in our next section.

#### THE ENZYME AS THE GROUND OF HEREDITY.

The difficulties which neo-vitalists urge against the mechanistic theory of heredity may perhaps be adequately summarized as follows. In the first place the germ-cell, which must be regarded as of prime importance in any mechanistic view of heredity, is said to be too small to contain a physical machine that shall be capable of determining with accuracy all of the intricacies of structure and function which are exhibited by the higher organisms; in the second place no *definite conception* has been advanced to show how such a hypothetical determining influence can exist. Weismann's theory that the manifold properties of the individual living organism are dependent upon the presence within the germ-cell from which the individual develops, of minute material units corresponding point for point with the separate characters of the organism, provides only the form and not the substance of such an explanation. It is our contention that the theory of enzymes not only removes the objection to the mechanistic account of heredity which arises from the extreme smallness of the germ-cell, but that it also provides us with an idea of *the definite chemical mechanism by which the contents of this*

cell determine the characters of the mature organism, and by which they direct its development. The conception of autocatalysis, also, clears up the third fundamental difficulty of the physico-chemical theory: that of accounting non-vitalistically for the self-reproductive power of the germinal system. With reference to the phenomena of heredity the theory of enzymes is essentially an extension or, better, an interpretation of Weismann's hypothesis.

The theory of enzymes maintains that the causal relationship which exists between the germ-cell and the organism into which it develops, or which exists between a parent and its offspring, finds its necessary material basis in the bodily or catalytic transmission of the original enzymes of the germ to each of the ultimate cells of the mature body. Upon the assumption that the native ferments of any cell constitute its visible "nucleus," a possible description of the manner in which cell characters are thus determined by the germ-plasm is suggested by the microscopically observed facts of "karyokinesis," or the maneuvers of the nuclear substance during cell-division. This process has been incorporated by Weismann in his theory, and since it enters into the theory of enzymes in an entirely analogous manner we need not give an account of it in this article.<sup>13</sup> But if the cell characters are actually chemically determined by catalytic substances which are present in the nucleus, it is clear that the highly elaborate mechanism of karyokinesis, which, in each case of cell-division, divides the nucleus into two parts and bestows one moiety upon each new cell, is nicely fitted to a transmission of cell characters from ovum to body tissue.

But when with this genetic idea clearly in mind we are confronted by the enormous complexity of many multicellular organisms, we realize that if the mechanistic conception is to hold, the initial cell must be exceedingly com-

<sup>13</sup> A. Weismann, *The Germ Plasm*, 1893, Chap. I, pp. 37-86.



plex; it can be no simple drop of homogeneous protoplasm, but must enfold within its tiny body a surpassingly intricate mosaic of separate characters. Moreover, throughout the successive stages of development by the segmentation of the primal ovum there must go on a sorting or sifting process in which certain characters are separated out and laid down, seeded, as it were, in definite portions of the body. We come to think of the germinal elements as sub-microcosms, representing or symbolizing the organic body in detail. The ovum and the sperm must be regarded as architectural structures built up by the conjunction of a vast number of unit enzymes, which during development are taken down in successive steps and segregated in different organs and tissues where they exercise, by virtue of their catalytic power, that specific control or regulation which has so mystified modern physiologists, and has encouraged so many vitalistic diatheses of mind.

The observed facts of the relationship of heredity are such as to confirm this conception of the mosaic and zymotic nature of the reproductive elements. The phenomena first described by Mendel in 1865 present a case in point. It is noted that an organic characteristic like tallness in plant body, or the redness of blossoms, or an hereditary deformity, acts in experiments in the crossing of different varieties of a species as if it were a definite and discrete quality, which in any particular hybrid is forced either to appear or to be entirely absent, which cannot, in other words, be mixed, blended or compounded with a different character. It is this set of facts which leads to the conception of "bio-types," and which is so consonant with the demands of the De Vriesian doctrine of mutations, and also—as we have seen—with the theory of enzymes. The idea that the "unit characters" of Mendelism are, in their substantial aspect, specific enzymes embodied in the germ-cell and manifesting themselves in the developed organism, is almost inevitably

suggested by the facts; many Mendelists definitely compare the "unit character" to a ferment.

The characteristic activities of any special *tissue cell* may be conceived as governed by the presence in its cytoplasm or nucleus of specific enzymes which facilitate certain types of chemical change. These are the "biophores," or life-bearers, of Weismann's theory. But it is clear that when the development of the organism is yet incomplete there will exist many more or less undifferentiated tissues, and in the cells of these we should expect to find a variegated store of biophores, presaging the further differentiation of the living stuff which is there present. Since rudimentary tissues of this sort are divisible into more or less discrete systems, as nervous, skeletal, alimentary, etc., we might expect to find a corresponding systematization among the controlling enzymes. Such groupings of biophores are called by Weismann "determinants." In a still more undeveloped state the enzymic contents of the organic cells will be even more complex, and will be divided into more comprehensive systems, which Weismann denominates "ids" and "idants." Each "id," according to the author of the theory, contains the potentialities of a complete organism; the "determinants" are units corresponding with the number of independently variable organic parts, and the "biophores," in our interpretation, are the ultimately life-regulating enzymes. It will readily be seen that the Weismannian mechanism of heredity is in perfect harmony with the elementary laws of Mendelism, and it is also consonant with the facts which have been established by the direct microscopic observation of the cell.

Upon our assumption that the "determinants," "ids," and "biophores" of Weismann, the "unit characters" of Mendelism, and the specific attributes of living matter in general are actually representations of the presence and

distribution of definite enzymes or organic catalysts in the body and in the germ, what shall be the line of argument taken in an attempt to elucidate the processes through which the organic characters of living matter are developed under the influence of the original germinal ferments? Clearly the matter will not be a simple one, but nevertheless it seems advisable to mention some of the conceptions which the physiologist of development must use if he is to attempt a *zymology of heredity*. His ruling idea, of course, must be that same conception of a specialized catalyst which was outlined in the second section of this paper.

Zymology has already gone far enough for us to assert the empirically demonstrable existence of hundreds of bodies of this type. But the interrelations of enzymes with each other and with the substances whose reactions they affect are very diverse. We must recognize the possibility of—so to speak—an indefinite number of degrees of *zymicity*, from enzymes which take absolutely no part in reactions under their influence to others which are gradually or rapidly consumed by the chemical forces which they encounter. Besides ordinary catalysis we may have to deal with “negative catalysis” for certain bodies interfere with the catalytic effects of enzymes or of inorganic catalyzers. The presence of such “anti-enzymes” may be employed by the hereditary zymologist in accounting for the inactivity of enzymes which are present in tissues but which fail to produce in them their characteristic effects. The “kinases,” or “co-enzymes,” must also be taken into consideration. These are empirically demonstrable bodies which are capable of catalyzing catalysts, or at least of reacting with certain other bodies, “zymogens,” to form enzymes. It is clear that the enzymes concerned in the development must all be capable of self-reproduction, or of autocatalysis, and in the mazes of this process may lie the ex-

planation of many strange phenomena. The structure of any given cell—based in the last analysis upon prior enzymic activity—its component membranes and their osmotic permeabilities, must also inevitably enter into questions concerning the points of equilibrium of catalyzed reactions, etc.

Can the theory of enzymes cope with the difficulties of the problem of heredity? It is our belief that it will be able to do so. The enzyme meets perfectly the requirements which must be satisfied by any physical entity purporting to be able to form the basis of the elementary hereditary relationship. Its most characteristic effect upon chemical mixtures such as that which is presented in the almost watery constitution of the living organism is that of regulation, and it is recognized by every one that the hereditary relationship is *par excellence* one in which regulation occurs. Upon purely chemical grounds it is found legitimate to endow the enzyme with that supposedly peculiar property of life: self-reproduction or regeneration. The theory of enzymes thus satisfactorily disposes of one of the fundamental vitalistic objections to the Weismannian hypothesis as it was originally formulated, and permits us to regard one of the most characteristic functions of living matter as a purely chemical phenomenon. But the enzyme also beautifully fulfills the geometrical requirements which are made by Weismann's typical mechanistic hypothesis upon the controlling entities of the germ-plasm.

As we saw in the second section, catalytic effects are remarkable for the small quantity of catalytic substance which is required to produce them; one part of catalyst in many millions of reacting substance will often suffice to bring about a very great acceleration of the reaction velocity. It can be shown by a simple calculation that the human germ-cell is sufficiently large to contain a million molecules of specific enzymic material for each of the bil-

lion or more cells in the human organism. These million molecules of course constitute a very minute portion of matter, but since they are both catalytic and autocatalytic they may be relied upon to produce far-reaching changes in the other chemical substances which come into contact with them. The theory of enzymes complements Weismann's hypothesis in another way by showing how it is possible that the germinal determinants should actually be effective in the development of the organism. It is one thing to show that the germ-plasm may contain an element for each specific part of the body which springs from it, and quite another to explain how such a material particle can determine by purely physical laws the peculiar development of that body.

#### THE ENZYME AS THE BUILDER OF ORGANISMS.

The most powerful of the unfavorable criticisms which have been brought to bear upon the physical theory of life during modern times have been founded upon the results of the new science of "experimental morphogenesis," or the empirical study of individual development. In an article such as this it is impossible to present and analyze in detail the results of this new and fascinating line of investigation, but as any one knows who is acquainted with the writings of Hans Driesch,<sup>14</sup> the most philosophical student of the new science, the physico-chemical theory of development cannot rigidly maintain the logically simple form given to it by Weismann, if it is to harmonize with all of the facts. The manner in which the germinal determinants are distributed in the process of cell multiplication cannot be thought of as a perfectly straightforward differentiation, in which every cell-division signifies the production of a radical and permanent disparity between the enzymic constitution of the two resulting units of structure. The

<sup>14</sup> H. Driesch, *The Science and Philosophy of the Organism*, 1908, Vol. I.

differentiation of cell constitution must needs be conceived as gradual, relative, and perhaps never quite complete; in many cases differentiation may be an expression of processes of chemical suppression or interference, rather than of the actual loss or exhaustion of the original determinants of the germ-cell.

At first sight it may seem that a failure on the part of the mechanist to present a logically simple hypothesis of development which shall explain all of the facts places him in a rather embarrassing situation; but this is not actually the case. Indeed, quite the reverse is true. If the mechanism of development were describable in simple formulae, this fact would add cogency to the vitalistic contention that some intelligent principle had been at work in the establishment of this mechanism. The mechanist is prepared to discover in embryological processes the effects of crudely diverse means of adaptation, of both rudimentary and vestigial developmental tendencies, and of a type of correlation between internal and external forces which is—so to speak—ragged-edged and diffuse. If we adopt the point of view thus suggested we shall find that many of the objections which have been raised by vitalism against the physico-chemical theory of life, on the basis of experimental embryology, will lose much of their cogency. All of these objections are founded upon the hidden assumption that a mechanistic account of the causes of individual development must be logically simple, that if the mechanist employs catalysis in his explanations he must make no concomitant use of osmosis, that if there are material hereditary determinants in the nucleus of the cell there cannot at the same time be any such in the cytoplasm, that if these determinants have a causal efficiency in the process of differentiation and growth general physical and chemical influences are thereby ruled out.

We have offered the above generalizations in lieu of

a detailed discussion of the vitalistic arguments of Driesch and other students of embryological development, not only because the limits of this article forbid such a discussion but also because the facts of "regeneration" and recovery from injury on the part of embryonic tissues have no special bearing upon the enzymic theory of heredity and development. The objections based upon these facts must be rebutted if the enzyme theory is to hold, but they are applicable to any mechanistic hypothesis whatsoever. Weismann's doctrine of germinal determinants in its simplest form assumes that there is a progressive simplification of the determining material of the body cells as individual development proceeds, and if this is what actually occurs it is of course impossible that one of these simplified cells should be able itself to generate any organic system different from or more complex than that of which it forms a homogeneous part. Thus a liver cell might be able to generate further liver cells, but it could not provide the starting point for the development of a new organism, or for the replacement of a missing limb. Certain exceptions to this apparent corollary of the Weismannian theory have been discovered in embryological research, and have been avidly appropriated by vitalism for use in its contest with the physico-chemical theory of life.

The general explanation which the mechanist will probably be forced to make of these exceptions lies in the supposition that all of the cells making up a given portion of an organism are not equally differentiated as regards their nuclear or enzymic substance, but that at every stage in the process of cell-simplification which is supposed to accompany development, certain cells are left behind and that these—since they possess an adequate complement of enzymic material—can, upon receiving the appropriate stimulus, regenerate any required "lost part." Residual or latent cells of this sort all belong to the same general type



as the germ-plasm itself, which is known to coexist with the differentiated somatic cells of the organism.

It is essential that we should recognize the fact that there are a great many processes in the physiology of development, and of mature life, which are explicable upon a physical basis wholly apart from the directing and "self-determining" activities of the cell. Bionomics—the study of organic symmetry and related subjects—shows that differentiations of structure in animals and plants occur in fixed and parallel orders; the underlying facts of symmetry in the body reduce the strain upon the germ-plasm, the bilateral, radial and metameric repetitions of organic characters would not require new sets of determinants but simply reproduction of the old ones in accordance with some slightly modified symmetrical karyokinetic process. The modes of repetition, in fact, are found in many cases to depend upon purely physical and environmental conditions; the forces of growth are limited by other forces outside themselves, the laws of geometry and physics.

All of these considerations tend towards the judgment that the germ-plasm need by no means be as complex as the organism into which it develops. There are certain things which would happen to any mass of protoplasm exhibiting growth; the determinants of the cell have to react with other natural forces in the production of the organism, with its mature anatomy and physiology. But while there can be no doubt that as development goes on the events which occur in the body are determined more and more by the physical and chemical interactions of different organs and tissues, this need not be taken to mean that these events would ever have occurred if it were not for the special enzymic constitution of the germ-cell.

The differentiation of organic form in the course of individual development, and in the evolution of species, must ultimately be determined by *a control of the planes*

*of cleavage* of the individual cells. This control may very well depend, in the last analysis, upon the molecular form of the germ-plasm. Identical chemical units may be combined in a great variety of ways, and the ordered decomposition of specific molecular groups may be relied upon to determine the relative directions of cleavage of the dividing cells and thus to regulate organic form even without chemical differentiation. The theory of enzymes does not place the processes of heredity and development in exclusively chemical categories; it does not dispense with the mosaic or structural factor in the germ-plasm. Indeed, when we clearly understand the meaning of chemical terms, we see that it would be impossible to eliminate this factor, even though we desired to do so. It is therefore legitimate to suppose that the determining enzymes of the germ-cell are arranged in a practically constant order, the unfolding of which regulates the form as well as the physical and chemical properties of the body.

The manner in which an enzyme may control structural changes is almost too obvious to require comment. We have noted that substances exhibiting almost any conceivable property or set of properties can be built up from the primary materials of protoplasm; the element carbon is the most versatile member of the chemical world. But the reactions which generate such specific substances from the raw material of the cell-plasm may be controlled by special enzymes, and in the event of such regulation the reactions in question will occur only in regions already containing the requisite enzymes. But the position of specified enzymes at any moment in development will be determined, among other things, by their position and chemical relationships within the original germ-cell. The most primitive and the most important case of the enzymic control of structure is found in the reproduction of the germinal mosaic itself. Since each catalytic component of the mosaic

is entrusted with its own regeneration and since this regeneration can take place only in the proximity of the catalysts themselves the outcome of the autocatalytic changes must clearly be the practically perfect reduplication of the original system, both in respect to configuration and to chemical nature.

#### THE ENZYME AS THE GUIDE OF FUNCTION.

Modern physiology started out upon the assumption that all vital processes could be reduced to chemical and physical interactions, ultimately to a purely chemical causation, since all of the mechanical, thermal, and electrical changes which take place in the body are but the secondary expression of chemical energies, liberated in molecular reactions. The task of stating the exact chemistry of organic functions is one towards the completion of which a great deal has been accomplished; by untiring experimentation and argument we have acquired a fairly clear understanding of many of the activities of the animal and plant body. Such processes, for example, as digestion, assimilation, respiration, etc., may now be partially restated in chemical terms, and we can see how the more grossly physical changes occurring in the organism depend upon these finer molecular interactions.

But along with this scientific advance there has come ever more cogent evidence of the presence within the living body of constantly effective forces of regulation.<sup>15</sup> We may understand perfectly the purpose and chemical relationship of the bile—for instance—but have still to ask ourselves why it is that bile is secreted so constantly by the liver and not by the stomach, which is, and always has been, nourished by an identical chemical mixture, the blood. Moreover, how upon a purely chemical basis are we to explain the processes of growth and of repair? No doubt

<sup>15</sup> Cf. W. Mac Dougall, *Body and Mind*, 1912.

growth and repair involve chemical syntheses, but how are we to account for the fact that these changes are almost invariably of the right kind, and occur in the right place? It is the seemingly *teleological regulation* of chemical reactions which baffles the explanatory efforts of modern naturalistic physiology.

In many minor cases physiologists have discovered that specific bodily functions are under the control of special enzymes. This is the case with gastric and intestinal digestion, and it is seemingly true also of respiratory processes. They have even been able to go one step further and to show that the original production of the enzymes themselves is conditioned by the presence of still further enzymes of a higher order, the so-called "kinases." Here we have clearly suggested the idea that the regulation of the fundamental chemical reactions of the organism may ultimately be traced back to the original enzymic material deposited or left in the body cells during the course of embryological development, so that the control would causally revert to the constitution of the germ. If this suggestion were accepted it would not be hard to understand why this control should appear teleological, since we must perforce conclude that types of control lacking in utility would be eradicated in the struggle for existence, once they were supposed to depend upon the structure of the germ-plasm.

Is it not conceivable that most of the difficulties which are encountered by the chemical physiologist—difficulties, mainly, of accounting for certain more or less fixed types of regulation—may be cleared away by the theory of enzymes? This, indeed, is our thesis, for the enzyme is preeminently a regulator, and we have seen that in all probability it lies at the bottom of the relations of heredity and development with the processes of which the factors in mature physiology are immediately continuous.

Under appropriate circumstances enzymes may facili-

tate any conceivable variety of chemical change, whether it be one of synthesis or of decomposition. As we said at the outset enzymes lubricate chemical reactions so that they are able to reach their natural points of equilibrium with more than normal rapidity, and it makes no difference whether the attainment of this equilibrium point involves constructive or destructive operations. Accordingly enzymes may be the controlling factors in both phases of metabolism, the upward and the downward.

Enzymes fix the *organic position* of definite chemical changes, and in doing this determine the so-called specific energy of the organ or tissue which is concerned. The principle of specific energy is one of the broadest known to physiology, and stands for the fact that when particular masses of protoplasm are subjected to a stimulus they always respond in a characteristic and uniform way, regardless of the nature of the stimulus. If we inquire into the nature of this specific energy we find that its manifestations are most easily explicable upon the assumption that it is essentially enzymic in character, for enzymes are always specific and they are universally present in protoplasm.

There exists a good deal of physiological evidence to show that the characteristic reactions of cells depend upon the presence and nature of their *nuclei*. And, as we have already noticed, the cell-nucleus is supposed in the theory of Weismann to contain the hereditary determinants, and hence, in our hypothesis, the enzymes. Consequently we must regard the nucleus as the real connecting link between mature cell activity and the constitution of the germ, as well as between both of these and the evolutionary history of the species. But, as we have already intimated, this conception of the nucleus as the bearer of vital characters is not inconsistent with the concomitant presence of enzymic matter in the cytoplasm, or extra-nuclear portion of the cell.

But does not this physiological application of the theory of enzymes provide us with the skeleton of an explanation of that "teleological ordering" of vital phenomena which certain modern thinkers have found themselves at a loss to explain upon a physico-chemical basis? If it is true that all of the processes occurring within the living body are determined with a high degree of precision by the chemical zymotic constitution of the cell-nuclei, and if—as in our discussion of heredity and of individual development we have found reason to believe—the substance of the cell-nucleus is derived from and is chemically the same as certain portions of the original germ-plasm, how would it be possible for vital phenomena to have other than a "teleological ordering"? To speak of the geulation of organic functions as "teleological" is formally equivalent to the assertion that the processes in question are uniformly such as to conduce to the integrity and survival of the organism. But if all existing germ-plasms have been subjected, as we believe, to a rigid testing under "natural selection," the functions which they determine must perforce be of such a sort as to assist the species and the individual in their "struggle for existence."

One factor which tends to confuse the physiologist's judgment upon such matters as this is the great complexity of the bodily processes. This intricacy is especially perplexing whenever a function seems—so to speak—to possess *options*, when there are a number of ways in which a particular desirable organic change can be brought about. But this capacity which is often exhibited by organisms of "trying again" and in a different manner to consummate a certain effect cannot be brought forward as an argument against the hypothesis of chemical control which is offered in the theory of enzymes, for, suggestive as these "trial and error" methods are of conscious purpose, the number of "options" is limited, and each of these options can always

be referred to components of a complex evolutionary history of the species, components of experience or selection in which the typical organism has succeeded under varying conditions of reaction, in obtaining the same result by different means. Where actions are actually random we may of course refer them to the influence of the molecular chaos which may be effective in the individual as in the species whenever, as in the process of learning, new and accidental variations in behavior prove useful.

#### CONCLUSION.

As we stated at the beginning, this article purports to be nothing more than a vague outline of the theory of enzymes as it is concerned with the question of the origin and regulation of organic activity. From the nature of the subject-matter which it involves such a theory must of necessity be elaborate and detailed. We have been able to indicate here merely its general principles and points of application to biological problems. It must be left to further supplementary expositions, and to controversies, to bring out the details of the theory; and this is a field of inquiry in which details are of great importance.

It has been our purpose to show that the conception of the enzyme is not only of use in the explanation of such every-day processes as digestion and fermentation but that its explanatory power reaches down into the roots of life. *Life, according to our conception, is something which has been built up about the enzyme*; it is a corollary of enzyme activity. And we have attempted to show how this might be true by exhibiting the enzyme, first, as the creator of life, second, as the basis of its development and differentiation, and, finally, as the guide of its now observable functions. We have seen that by the use of the enzyme concept we can throw light upon practically all of the fundamental problems of biology, those of the origin of



living matter, of the source of variations, of the ground of heredity, and of the mechanism of vital regulation. These are the credentials of the enzyme theory of life; whether or not they will prove adequate to its acceptance the future alone can decide.

The theory of enzymes is advanced in this article in rebuttal of vitalism. Nearly all of the objections which are raised by neo-vitalists against the physico-chemical interpretation of life can be reduced to questions of the basis of vital regulation, and we have throughout striven to demonstrate that the concept of the enzyme provides us with a strictly physico-chemical mechanism of regulation, and on which is at the same time consistent with all of the fundamental peculiarities of the vital regulative principle, its self-reproductive power, its liability to variation, its physical minuteness, etc.

No doubt there are certain important points in vitalistic arguments which the enzyme theory does not directly affect. For example, we have not attempted to provide an explanation for the alleged facts of "orthogenesis," or of variation in a continuous direction. But special considerations will no doubt throw light upon questions of this sort.

Another problem which we have not touched upon is that of the origin and nature of consciousness. This is really a philosophical and not a biological issue, and its discussion involves a point of view wholly different from that of the present article. Even among vitalists the most intelligent thinkers do not confuse the problems of psychology and those of physical science.

Prof. E. B. Wilson, who is one of the foremost modern cytologists, has formulated the fundamental problems of heredity in the following four questions:<sup>16</sup> What is the physical basis of heredity? How is it transmitted from

<sup>16</sup> E. B. Wilson, "The Problem of Development," *Science*, 1905, N. S., XXI, pp. 281-294.

cell to cell? How does it transmit hereditary characters? How may it be so modified as to give rise to new heritable characters? It is our contention that in a general way the theory of enzymes satisfactorily answers all of these queries. It unmistakably provides a physico-chemical basis for fixed and definite inheritance, and for the "spontaneous" production of just those De Vriesian "mutations" which seem to be required by the modern study of the evolutionary process. The crucial problem of "Darwinism to-day" is that of the source of variations. Certainly the theory of enzymes makes obvious a solution of this problem which is not only in harmony with Weismann's hypothesis with regard to the hereditary mechanism but which, by its utilization of a well-known physical conception—that of the "molecular chaos"—decidedly strengthens the general bond between the organic and the inorganic.

In his analysis of the factors which enter into development Hans Driesch has expressed the actual fate of any specified cell of the embryo as a mathematical function of three variables:  $p.v.(X) = f(s, l, E)$ .<sup>17</sup> This means that the "prospective value,"  $p.v.$ , of the cell  $X$  is determined by the absolute size,  $s$ , of the mass of which it is a part, by its position,  $l$ , in that mass, and by a third factor,  $E$ . In the theory of Driesch,  $E$  represents the vital principle, which he calls "entelechy," and it is his main thesis that the factor  $E$  cannot correspond with any conceivable physical or chemical entity. Driesch asserts in his "second proof of the autonomy of life"<sup>18</sup> that "entelechy" is "at the bottom of inheritance." The "proof" which he offers is one which is readily rebutted on the basis of the theory of enzymes, but the fact which it is important for us to notice is that Driesch's "entelechy"—which is the most clearly formulated vitalistic concept that has appeared in

<sup>17</sup> H. Driesch, *The Science and Philosophy of the Organism*, Vol. I, p. 132.

<sup>18</sup> H. Driesch, *The Science and Philosophy of the Organism*, Vol. I, p. 224 ff.

the history of human thought—has charge of all of the specifically regulative functions of the organism. It is the ground of every complex purposeful adaptation; in a word, it accomplishes just those tasks which we have assigned to the enzymes of the germ-plasm. And, conversely, if due allowance be made for the great structural intricacy of the reproductive mechanism as necessitated by its evolutionary history, we shall find that there is nothing which can be performed by “entelechy” which cannot equally well be mediated by the enzyme. Is it not, then, legitimate to parody the symbolism of Driesch, and to write:  $E = enzyme$ ? That this is an equation the possibility of which the great vitalist himself will find it difficult to deny upon reasonable grounds is suggested by the results of his painstaking and altogether too exact analysis of the conditions under which “entelechy” is able to interfere with the course of physical events. In the Gifford lectures for 1908—on “The Philosophy of the Organism”—Driesch arrives at the conclusion that the point of contact between the vital principle and material changes may be found in the “activation” or release of enzymes within the protoplasm.<sup>19</sup> But it is a well-known fact that in many cases such an “activation” is conditioned by the presence of—so to speak—enzymes of the second order: the “kinases,” which we have already mentioned as probable factors in the developmental process. It would appear, then, that the arguments of Driesch himself lead their author unconsciously to the door which, when opened, will reveal the enzyme—and not the mystical “entelechy”—as the pilot of life’s journey.

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<sup>19</sup> H. Driesch, *Op. cit.*, Vol. II, p. 187.

## CRITICISMS AND DISCUSSIONS.

### THE ECONOMY OF THOUGHT.

#### I.

From the earliest times until the seventeenth century mathematicians were chiefly occupied with particular questions—the properties of particular numbers and the geometrical properties of particular figures, together with simple mechanical questions concerning centers of gravity, the lever and so on. The only exception to this was afforded by algebra, in which symbols (like our present  $x$  and  $y$ ) took the place of numbers, so that, what is a great advance in economy of thought and other labor, a part of calculation could be done with symbols instead of numbers, so that the *one* result stated a proposition valid for a whole class (often an infinity) of different numbers. Such a result is that which we now write:

$$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3,$$

which remains valid when we substitute any particular numbers for  $a$  and  $b$ , and labor in calculation is often saved by the formula even in this very simple case.

This reflection, which is quite an evident one, came in an article of mine on "The Relevance of Mathematics" published in 1909.<sup>1</sup> In a note, I referred to some criticisms on Mach's idea of the economy of thought in science, which had been made by Mr. N. R. Campbell.<sup>2</sup> Mr. Campbell's objections seemed and still seem to me to rest on a misunderstanding of what Mach really meant. This is part of the note:

"Perhaps the phrase 'economy of thought' is not well chosen, and may lead to such misunderstandings; the principle is meant to direct attention to a rule of scientific method which can be readily admitted, and certainly the goal of science will not 'have been attained' when its students, guided by this principle, have ceased to think."

<sup>1</sup> *Nature*, Vol. LXXX, 1909, pp. 382-384.

<sup>2</sup> *The New Quarterly*, Vol. I, 1908, p. 498.

This rule may be thus described. As science advances, besides actually overcoming an obstacle, it consciously or unconsciously leaves marks of guidance for those who come after; so that those obstacles which required great genius to overcome in the first instance afterwards became quite easily so. This is necessary in order that our energies may not be spent by the time that we reach a new obstacle not hitherto surmounted; and 'economy of thought' means the sparing of waste of the energy of thought whilst treading the path already trodden by our predecessors, so that we may keep thought for the really important new problems—not that we may cease to think about new problems.

"And thus we have legacies left by great men, such as Lagrange's analytical mechanics and Fourier's theory of the conduction of heat, which are merely inventories of extensive classes of facts, arranged with wonderful compactness.<sup>3</sup> In this description of an infinity, perhaps, of facts by a *few* formulas, there is undoubtedly an esthetic motive and value; but apart from this there is this important economical aspect: that a multitude of particular facts and 'laws,' which we had hitherto to remember, actually or artificially (in a note-book or library), is, in the theory, comprised in a few symbolical formulas, which only require *logical* development to get at the particular cases. From this point of view we get the apparent paradox that 'economy of thought' leads to the replacement of memory by reason. The solution of the paradox is that logical development can be made more mechanical even than memory, and that thus thought is spared, so that we can concentrate it on the unsolved problems which are always coming into our field of vision as we advance.

"The tendency to economy of thought, which is shown in the growth of physics—for example, in the inclusion of the particular Biot's law of the distribution of temperatures in Fourier's theory<sup>4</sup>—may also be seen in the symbolism of pure mathematics."

## II.

This criticism of a criticism led to a hitherto unpublished discussion between Mr. Campbell and myself. As I think there are points of interest about this discussion, I proceed to give some account of it.

Mr. Campbell replied to my remarks on his criticisms of the

<sup>3</sup> Cf. Mach, *Die Principien der Wärmelehre*, 2d ed., Leipzig, 1900. p. 115.

<sup>4</sup> Cf. *ibid.*, p. 81.

principle of the economy of thought in a letter of May 28, 1909, addressed to the editor of *Nature*. This letter and the subsequent discussion were too long for the correspondence columns of *Nature*, and through the courtesy of Mr. Campbell I am here enabled to give a reproduction of his letter:

"In his article on 'The Relevance of Mathematics' Mr. Jourdain seeks to refute some criticisms of Professor Mach's principle of 'economy of thought,' which I made in a recent number of the *New Quarterly Review*. Since my reference to Professor Mach was only incidental, perhaps I may be allowed space to elaborate my position a little further in reply to Mr. Jourdain.

"Mr. Jourdain says that Professor Mach does not mean what he says, and in this I agree with him. If I imagined that he really intended to assert so ridiculous a principle, I should not have so very great a respect for his writings. But undoubtedly he has been taken literally by many people, and it is therefore permissible and desirable to criticize the letter as well as the spirit of his statements. Accordingly I must point out again that, if the object of science is the economy of thought, the best science is that which requires no thought: 'The object of science will be attained when its students have ceased to think.' Nobody can consistently maintain the literal interpretation of Professor Mach's principle and hold at the same time that science has the smallest intellectual value.

"According to Mr. Jourdain the principle that Professor Mach intends to assert is that of the economy of memory at the expense of reason. I repeat that this may be what Professor Mach means, but it is certainly not what he says; for reason is as much 'thought' as memory. But, if the principle is put in this form, I agree readily that it describes roughly the motive of a great part of what is ordinarily termed 'science,' for memory is the most obvious example of a form of thought which has no esthetic value for most minds. Laws are, indeed, partly efforts at the economy of memory at the expense of reason, but their value lies at least as much in the expenditure of reason as in the economy of memory. Landolt and Börnstein's tables are far more efficient in saving memory than all the laws that were ever discovered, but nobody (except, perhaps, certain chemists) would consider them the ideal of a science.

"It is in connection with theories that the principle of the 'economy of thought,' taken literally or interpreted by Mr. Jourdain, is so utterly absurd. (I have explained the distinction between a law and a theory in the article to which Mr. Jourdain refers.) It

is perfectly true that theories *might* save memory, but it is perfectly untrue that they *do* save it, or that it is for their economizing properties that they are valued by men of science. For conviction on this point Mr. Jourdain has only to examine our practice. Does a physicist, when he wants to know the effect upon the volume of a given mass of gas of changing the pressure, reflect for a moment upon the kinetic theory of gases? Would an astronomer, accosted suddenly, confess complete ignorance of Kepler's laws and ask for time to examine the consequences of the theory of gravitation? Of course not. No man in his senses ever reconciled himself to forgetting a law because he knew of a theory by which it was explained, for the simple reason that the mental effort of deducing the law from the theory is even less pleasurable than that of remembering the law. A theory economizes nothing. It is a pure addition to our thought, and it is valuable in proportion to the value of that which it adds. If science were merely an elaborate method of pampering the mental indolence of mankind, it would be better left to those who care for nothing but a base utilitarianism. It is because theories provide us with ideas the contemplation of which is of the very highest esthetic value, that science is a worthy employment for the noblest intellects.

"The failure to distinguish clearly between the relatively unimportant law and the essential theory, which marks the work of most of those who write of the 'philosophy of science,' is due largely, I think, to the fact that so many of these authors are primarily mathematicians. They naturally seek for some motive in science which presents an analogy to that which inspires their own splendid study. The rationale of pure mathematics is, if I understand rightly the treatise of Mr. Bertrand Russell, absolutely unique among all forms of thought, but there is in its methods some element which shows a rough, a very rough, analogy to the formation of scientific laws. But no opinion could be more erroneous than the prevalent view that mathematics and science are closely connected species of a single genus of thought. The essence of a science is its theories, and for a theory the analogy is to be found not in mathematics but in metaphysics, and still more in art. The debt of physicists to mathematicians is incalculable, but when their long and fruitful intimacy leads to the development of a '*Naturphilosophie*' which respects nothing but 'facts,' and to the glorification of that magnificent lie, *Hypotheses non fingo*, on that part of him who alone in his stupendous genius could embrace the highest developments of instincts



so diverse as the mathematical and the physical, it is time to insist that it is a mere friendship and not a deep tie of blood and lineage."

## III.

This letter, which was forwarded to me at the time (June 3, 1909) by the editor of *Nature*, suggested to me some reflections of which the following is a copy:

"The chief difference between Mr. Campbell and myself seems to be concerning the ends of science. With Mach, I believe that the object of natural science is to complete in thought what we observe only slowly and partially; this object seems to me, at bottom, a practical one. It is true that science gives us noble ideas for our contemplation; this fact comes home to one in spite of its constant repetition in works on popular science. But it is, I think, a mistake to lay exclusive stress, as Mr. Campbell seems to do, on this purely intellectual function of science, and to depreciate its more obviously utilitarian aspects. Even if astronomy had no other purpose than to produce the *Nautical Almanac* it would be hard on it to call its purpose "base." If Mr. Campbell is right, then: (1) the essence of science is much more like art than I had supposed; (2) not only have many readers misunderstood Mr. Russell's work, but also Mr. Russell himself, for he maintains that the rationale<sup>5</sup> of pure mathematics is not unique among forms of thought, but *is* logic; and lastly (3) science is merely friendly to logic and not otherwise related to it. So Mr. Campbell's rightness would mean that the hopes of many of us must be given up.

"Until I read Mr. Campbell's letter, I maintained that the real meaning of Mach's principle of the economy of thought in science was that of the replacement of memory by reason. In fact, the obvious saving of labor occasioned by a formula valid for an infinity of cases, as compared with a set of tables which, often inaccurately and always incompletely,<sup>6</sup> try to fulfil the same purpose, appeared to me so supremely important that I overlooked the importance of a literal economy of thought in science, and Mr. Campbell, by attack-

<sup>5</sup> [Here I take this word to mean the *essence* and not the *methods* of mathematics. The methods used to discover logical propositions need not, of course, be logical.]

<sup>6</sup> "By this, I mean, of course, that no table of the values of a function can give the infinity of particular values of it that we can obtain from a formula. If this is said to be immaterial for practical purposes, there is a vague hypothesis made in that statement about the nature of the function in question; and it is mathematics alone which can state exactly what this hypothesis is."

ing what I did not say, but ought to have said, has rendered me a great service.

"When a man pleads for the economy of thought in physics, there is no more implication that his ideal is a cessation of the need for students to think at all than there is a like implication in his pleading for a symbolic logic. We know how some old-fashioned logicians used to regard symbolic logic: their ignorance of it and its objects merely increased their contempt for it. And by way of reply, I need only refer here to Mr. W. E. Johnson's<sup>7</sup> just emphasis on the fact that 'a symbolic calculus is an instrument for economizing the exertion of intelligence,' which is necessary because the 'intellectual intuition which perceives the truth of laws in their simple—but absolutely universal—form is incompetent to perceive the same truths in more complicated forms.' By a purely mechanical process we do what unaided intelligence cannot do; we do not attempt the impossible,—the total banishment of intelligence from a science concerned with inference.

"But, though we do not wish to banish thought, we do act in such a way as to spare ourselves unnecessary use of it. I am guilty of overlooking this fact, owing to a mathematical bias in favor of a formula over tables. Of course, when one comes to think of it, to abstain from the use of a table of logarithms, and to work out one's logarithm from first principles, would be eccentric. What is most important in the advance from a tabulated function to the law of the function seems to me to be that, by establishing a logical connection between its descriptions of various phenomena it reduces the number of our scientific principles. Before universal gravitation was formulated, we had at least three laws (those of Kepler) of planetary motion. Kepler's laws are still, doubtless, remembered by astronomers—they are not by all mathematicians—, just as tables are used, to economize mental effort that does not add to our knowledge. And Mr. Campbell admits this. We remember Kepler's laws, he says, because 'the mental effort of deducing the law from the theory<sup>8</sup> is even less pleasurable than that of remembering the law.' And yet, to read the first part of Mr. Campbell's letter, one would think that he objected to this admission of his.

"To sum up, Mach's principle, even when taken literally, is not 'ridiculous.' Men of natural science use it to an extent mathematical

<sup>7</sup> *Mind*, N. S., I, (1892), pp. 3, 5; cf. Mr. A. N. Whitehead's *Treatise on Universal Algebra*, Cambridge, 1898, p. 4.

<sup>8</sup> "What Mr. Campbell here calls the 'theory,' I call the 'formula' (of gravitation)."

people hardly realize—even Kepler's laws are used to save trouble. Secondly, science proper is not concerned with its 'intellectual value.' That it has such a value all admit, but even if it had not, the fact would be irrelevant to science; it would merely fail wholly to displace classics where knowledge is not reckoned by its cash value in ordinary affairs of life. Thirdly, even when I admit that what Mr. Campbell calls a 'theory' has a significance which is not only economical but also logical, I still find myself in disagreement with Mr. Campbell, since he insists that there is no relationship between physics and mathematics (and consequently logic). Fourthly, from our wishing to economize thought as much as possible, it does not follow that our ideal is to abolish it."

## IV.

To this discussion I will append a few remarks.

The question is largely one of terminology. Following Mach, I call a "theory" a collection of propositions which describe a domain of experience closely and concisely, and keep the name "hypothesis" for a proposition from which some or (preferably, of course) all of the known facts can be deduced, but which cannot be logically deduced from propositions describing the facts alone. It has occasionally happened that facts hitherto unknown can be deduced from the hypothesis, and certain persons have concluded too readily that such a deduction confirms the hypothesis. However, the hypothesis would only be confirmed if it could be proved that *all* the facts—known and unknown—are in the domain of experience which the hypothesis is supposed to cover. A hypothesis may be true or false; a theory, being a description of the facts alone, is true if, indeed, it does represent the facts.

Mr. Campbell seems to use the word "theory" in the sense in which I have used the word "hypothesis." It may be that "theory" is a more appropriate term for what I have called "hypothesis"; the verbal point need not be argued. And I propose to call Mr. Campbell's "theory" by the name "theory (C)." What is called "the kinetic theory of gases" is a theory (C), and consequently is not what I called a theory. I thought that Mr. Campbell might object to what he called a "theory" being called a "hypothesis," but I am not sure; at least he says that a physicist lies if he says *Hypotheses non fingo*. Further Mr. Campbell used one word "theory" for what I would call the kinetic "hypothesis" of gases and the "law" or "formula" of gravitation.

Mr. Campbell considers that it would be mad to undergo the mental effort of deducing a law from what he calls a "theory," when remembering the law costs less effort; and yet he seems to consider any economy of thought a theory might have as of very small account as compared with the esthetic value of the theory. So far as I can see, it might be more beautiful always to forget laws and deduce them from a theory; then Mr. Campbell would have to admit that the noblest intellects might belong to mad people.

One of the principal functions of science is the reducing of the processes of thought which have already, perhaps with great labor, been gone through by the pioneers of thought, to a mechanism which can be worked by almost anybody without much new thought being required. The point of this is that the energies of those who succeed the pioneers and the systematizers, and the pioneers' work may be spared for the attacking of new problems. Science is not and never will be completed; consequently there will always be new problems, and the state in which all thought is replaced by mere mechanical operations, whose existence would imply that finality in science were reached, will never come to pass. It is this function of science that is the economy of thought; and I emphasized this function in my article more than in my reply. Since my article was written, I have been much encouraged to continue to hold my opinions by reading in Dr. A. N. Whitehead's admirable little book entitled *An Introduction to Mathematics*, the following sentences: "The interesting point to notice is the admirable illustration which this numeral system affords of the enormous importance of a good notation. By relieving the brain of all unnecessary work, a good notation sets it free to concentrate on more advanced problems, and in effect increases the mental power of the race."<sup>9</sup> Then again:<sup>10</sup> "...by the aid of symbolism, we can make transitions in reasoning almost mechanically by the eye, which otherwise would call into play the higher faculties of the brain. It is a profoundly erroneous truism, repeated by all copy-books and by eminent people when they are making speeches, that we should cultivate the habit of thinking of what we are doing. The precise opposite is the case. Civilization advances by extending the number of important operations which we can perform without thinking about them. Operations of thought are like cavalry charges in a battle—they are strictly

<sup>9</sup> Home University Library, London and New York, 1911, p. 59.

<sup>10</sup> *Ibid.*, p. 61.

limited in number, they require fresh horses, and must only be made at decisive moments."

## V.

In a little book entitled *The Principles of Electricity*, which has been lately written by Mr. Campbell for the inexpensive and useful series called "The People's Books,"<sup>11</sup> he has stated his views on the nature and function of scientific "theories" very clearly.

A scientific "law" is<sup>12</sup> "a collection of simple statements about the occurrence of sensations, but it is not a mere collection; the statements are arranged in a definite order, and connections between them are asserted. Thus the statement of 'amber has been rubbed' represents part of the collection, and the statement that 'amber attracted light bodies' another part; the whole statement does not merely affirm both of these partial statements, but asserts also a connection between them, in that the first sensations represented by the first partial statement occurred before those represented by the other; the kind of connection between the ultimate statements, in which one set of sensations is affirmed to occur before another, is the one which has attracted far the largest share of the attention of writers on the philosophy of science, and the term 'law' is usually confined to propositions in which this connection is very obvious. But it is by no means the only kind of connection which is asserted in scientific statements. Thus the statement that amber is rubbed implies the statement that there is such a thing as amber, and this statement in its turn, as we have seen, means that there is a thing which is yellow, hard, brittle, and found by the sea. This statement may be again resolved into partial statements, such as there is a thing which is hard, that there is a thing which is brittle, and so on; each of which is a collection of statements of the occurrence of sensations. But here the connection between the partial statements affirmed by the complete statement, is not that one series of sensations occurs after the other; a substance is called amber if it is first observed to be hard and then observed to be brittle, or if the order of these observations is reversed. If, however, we proceed yet further and analyze the statement that this is brittle, we find that it means that after it is hit with a hammer it breaks into pieces; the connection of statements concerning the occurrence of sensations by dividing them into two groups, of which one is subsequent to the other, reappears."

<sup>11</sup> London and Edinburgh: T. C. and E. C. Jack.

<sup>12</sup> *Op. cit.*, pp. 12-13.

We may notice that, according to Mr. Campbell, it would appear that there was no place in natural science for hypothetical propositions. No proposition in natural science is analogous to that expressed by: "Trespassers will be prosecuted," unless there are in fact some trespassers. It is, then, rather misleading to state propositions of the form "electricity does such and such a thing" when no proposition that there is such a thing as electricity is yet known.

"It is important," says Mr. Campbell,<sup>13</sup> "to notice that the connection of invariable sequence is by no means the only one possible, and that it is very seldom, if ever, the only one occurring even in those statements which are universally recognized as laws. In these circumstances, the attempt to confine the term 'law' to those propositions in which this connection is especially obvious, appears to me artificial and misleading; and in the sequel that term will be applied indifferently to any proposition asserting any kind of general connection between the occurrence of sensations. We shall term 'laws' not only such propositions as that, when amber is rubbed, it attracts light bodies, but also such statements as that there is such a substance as amber, which is at the same time yellow, brittle, and the rest."

"And now," continues Mr. Campbell,<sup>14</sup> "we may ask how far will this process of establishing laws carry us; we can ultimately attain one law which will sum up *all* the observations which we have made and from which all those observations can be deduced, or shall we reach a stage when several laws are needed to describe all the observations and find that no further progress in the simplification of the description can be made? To answer this question thoroughly would need much more space and much more searching inquiry than is suitable in this place, but I think that there can be no doubt that the complete signification, resulting in the description of all the observations by one single statement, cannot be effected if that statement is to be a law."

If we remember Fourier's theory of the conduction of heat, we shall, I think, dissent from the conclusion that it is always impossible to find a law which will sum up all the observations made in a particular domain of science, and from which all these experiments result. What we call, after Fourier, the "theory" of the conduction of heat is simply a series of logical developments, made with the greatest mathematical skill and originality, of one proposition based on experiment—Newton's law of cooling. However, Mr. Campbell

<sup>13</sup> *Ibid.*, pp. 13-14.

<sup>14</sup> *Ibid.*, p. 17.

gives no grounds for his assertion that the connection of all the laws into one statement which shall be itself a law is not possible.

Yet these laws can be connected into one statement which is not a law, but another kind of proposition. And then Mr. Campbell<sup>15</sup> goes on to make a very curious justification for the search for this kind of proposition. The student of pure science "is forced to a new development of science beyond the formulation of laws, because the laws, even when he has got them, do not give him the intellectual satisfaction he seeks; he cannot accept them willingly as the end of his labors. It is quite impossible to say why he is not content with laws, just as it is impossible in the last resort to give any reason for an artistic preference, and fortunately there is no need to make the attempt. For my reader is supposed to be the plain man, and nobody feels more strongly than he the unsatisfying character of laws as an ultimate result of science; I can appeal to his own experience. If this little treatise were brought to a conclusion now, and the reader offered only the laws of electrostatics as the whole pronouncement of science on a great field of investigation, I think he would feel not only that the results were extraordinarily meagre, but that they were of the wrong kind. His natural instinct, unless it had been perverted by the mistaken admonitions of some people who ought to know better, would make him inquire 'why'? 'These laws are all very well,' he would say, 'but I have been expecting to be told why, for instance, charged bodies are able to attract uncharged, or only bodies which are conductors can be charged by induction.' That request voices just the need which leads men of science to their greatest discoveries." It is curious so to appeal to the instinct of the "plain man" when, later on,<sup>16</sup> that very sort of man is rather disparaged: "Those results [of science] are attained by flights of imagination of which the plain man is quite incapable."

"The fresh step, then," says Mr. Campbell,<sup>17</sup> "which we are going to take consists in the substitution for the laws which we have discovered of some other proposition or propositions which shall not be laws. And these new propositions have to fulfil two purposes: first, they have to be such that the laws can be deduced from them, and such that they sum up the laws as the laws sum up the individual observations; second, they have to be such that they give the intellectual satisfaction which cannot be obtained from the laws; for this latter purpose they will have to contain ideas which are more familiar

<sup>15</sup> *Ibid.*, pp 18-19.

<sup>16</sup> *Ibid.*, p. 28.

<sup>17</sup> *Ibid.*, p. 20.



than those of the laws." Such propositions are what Mr. Campbell<sup>18</sup> calls "theories," and he says that "it should be clear that it [the 'theory'] does represent a new development, and that it is perfectly possible to state the laws of the phenomena without any reference whatsoever to it. The help which it affords is doubtless due to the fact that it reduces the quite unfamiliar actions observed with the charged glass and silk to the quite familiar action of the transference of a substance from one body to another."

Mr. Campbell<sup>19</sup> is careful to point out the risk that there is in using "theories": "A theory suggests a great deal more than it actually asserts." He emphasizes<sup>20</sup> that "science in its highest form is not opposed to art, it is a form of art"; and he is scornful<sup>21</sup> about the study of science for utilitarian reasons. Of course this scorn is right; but it seems rather ungrateful not to remember that science was first developed from utilitarian reasons.

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#### AN ANSWER TO MR. BERTRAND RUSSELL'S ARTICLE ON THE PHILOSOPHY OF BERGSON.<sup>1</sup>

Mr. Russell concludes his criticisms of Bergson's philosophy with the accusation that he confuses subject and object in his theory of perception. "As soon as this identification is rejected," we are told, "his whole system collapses: first his theories of space and time, then his belief in real contingency, then his condemnation of intellect, then his account of the relations of mind and matter, and last of all his whole view that the universe contains no things, but only actions, movements, changes, from nothing to nothing."

The theory that in pure intuition the subject which knows *becomes* its object, is certainly of very fundamental importance for Bergson. In justice, however, it must be remarked that this identification is not the result of a confusion; neither does it apply to thinking by concepts. Therefore Mr. Russell caricatures this theory when he says, "If subject and object are one... my friend Jones, though he believes himself to be in South America and to exist on his own account, is really in my head and exists in virtue of my thinking about him; St. Mark's Campanile, in spite of its great size

<sup>18</sup> *Ibid.*, p. 23.

<sup>19</sup> *Ibid.*, pp. 25-26.

<sup>20</sup> *Ibid.*, p. 28.

<sup>21</sup> *Ibid.*, p. 18.

<sup>1</sup> See *The Monist*, July, 1912, Vol. XXII, pp. 321-347.

and the fact that it ceased to exist ten years ago, still exists, and is to be found complete inside me."

Thought about, knowledge by, concepts, involves the distinction between subject and object. It is only in pure intuition that Bergson ever claims that this distinction is transcended. It may fairly be questioned whether such a claim can be justified, but in any case criticisms levelled against Bergson's theory and perception as though it applied to conceptual thought will always be wide of the mark.

There are parts of Bergson's philosophy which are based upon this identification of subject and object, but there is much that is quite independent of it. Setting it aside for the present, therefore, let us consider one by one the important points in Mr. Russell's criticism.

First concerning space.

Mr. Russell's criticisms seem to rest here on a misunderstanding as to what Bergson means by space. The word is perhaps misleading. I believe the truth is that Bergson applies the term "spatial" to any series of distinct units in relations. Mr. Russell himself quotes a passage from *Creative Evolution* in which "spatiality" is described as "nothing but separateness." If this is Bergson's meaning, it follows by definition:

- a. that *greater* and *less* imply space;
- b. that every plurality of separate units involves space;
- c. that all abstract ideas and all logic are spatial.

We may therefore pass over Mr. Russell's objections to these statements.

Again, if "spatiality" means forming a series of distinct units, this explains why Bergson calls thought "spatial."

The intellect operates with ideas and concepts and relations, all of which are distinct units, and it is for this reason that Bergson condemns it. Mr. Russell is therefore wrong in saying that this condemnation "depends upon supposed habit of picturing things side by side in space." The same answer applies to his suggestions that Bergson "mistakes a personal idiosyncrasy (i. e., that of visualizing) for a necessity of thought."

In connection with space, Mr. Russell raises the question of continuity in change. Whenever Bergson attacks the mathematical explanation offered for change on the grounds of consistency, Mr. Russell can at once crush him.

Bergson's real objection to this explanation of change, however, is not concerned with its logical consistency. His real charge against

the so-called explanation of change by means of a mathematical continuum is that this explanation leaves out the essential things which is the *process of change*.

The fact is that Bergson starts from the intuition of a kind of change whose essence is indivisible continuity. A so-called continuum made up of distinct units in relations, even though they be infinite in number, is, for him, discontinuous.

He believes that change is a process. We may call this process an indivisible continuity, but this really only comes to the same thing as saying that a continuum composed of units in relations does not truly describe it. Now mathematicians deny that there is any such thing as a process of change. They say that an infinite series of different states in relation to an infinite number of different moments is all we mean by change. Clearly, any argument directed against Bergson which starts from this assumption begs the question.

Bergson claims that change is not made up of any number of unchanging states, and that therefore the explanation of it in terms of a series of states leaves out the essential thing, the process; change consists simply in a process of changing.

So long as Mr. Russell assumes that we do not mean anything more by change than can be explained by a series of points, he and Bergson will always be arguing about different things. Mr. Russell seems to be partly aware of this when he says, that "whether (Bergson's theory of change) is *possible* is a question which demands a discussion of his view of duration." A better way of putting it would be to say that Bergson's theories both of change and of duration depend upon the assumption that change is a process and not a series of points. It is because Mr. Russell never seriously tackles this assumption that his criticism of Bergson does not seem to go to the root of the matter.

Before we pass on to his criticisms of duration, therefore, I propose to try and explain what is meant by saying that change is a process and not a series. If this could be made clear the task of answering Mr. Russell would be easier. Bergson himself, however, must not be held responsible for the following attempts at explanation—they merely stand for what I have understood him to mean and he may well disclaim my interpretations as quite false.

It would have been simpler to divide the problem into two separate questions: (a) What is meant by a process of change? (b) Why should we suppose that the mathematical description of change is unsatisfactory? Unfortunately this division cannot be

made, because any attempt to define what is meant by a process of change will be circular. Change in process is, in fact, indefinable.

It is claimed that if we try to describe change we have always to regard it as *change completed* and not *in process of changing*. But change completed is something *unchanging*. We can therefore only describe what is unchanging, never change itself. We must leave our first question, then, and pass to the second.

Why should we suppose that the mathematical description of change is unsatisfactory?

We will grant at once that this description is self-consistent. The objection to it therefore must be that it does not describe objective reality as we know it. Change is described by mathematics as a series of states in relations. This description is objected to on the grounds that real change is no such thing.

Let us consider carefully what we know of change. In perception the data are already divided by our senses and our power of attending to one thing at a time. Out of this material the human intelligence has constructed a vast scheme of things and events, filling up the gaps (inevitable to the intermittent attentions of a finite consciousness) by the help of inference. This inference is verified by subsequent perceptions.

What reason have we then for supposing that the data of our perceptions are not parts of objective reality, and that this constructed scheme of things and events is not a true account of objective reality itself?

It cannot be denied that such a world as is given by this scheme would at least be possible, and equivalent for all practical purposes to the reality that we know. Moreover this is just the kind of world that the data of perception would naturally lead us to expect. It is claimed, however, that our knowledge of change does not come from perception and that we *know* objective reality to be a process of change by immediate acquaintance more direct even than perception. If we compare the description of change offered by mathematics with this direct knowledge of it, we find that the description does not describe change at all: it leaves out the essential thing, the process.

It seems then, that we have reached a dead-lock. Even if we assume that we have this direct knowledge of the process of change, we cannot describe it any further. The difficulty is to see how thought and language can apply to this direct knowledge (even sup-

posing we have it). If change is indefinable what is it that we do when we think we are thinking about it and describing it?

To begin with, thought and language can create symbols to direct our attention to experiences *about* which we cannot think. The concept and the word "change" are such symbols. If it be assumed that we can know change itself, the process, though we cannot think about it or describe it, then at least symbols can direct our attention to our immediate knowledge of it. They are its proper name and cause us to think and talk *of* it. (By *thinking of* it I mean attending to our immediate knowledge of it.)

But thought can do more than this. Besides thinking *of* change, we seem also to be able to think *about* it.

Even admitting that all attempts to define change would prove unsatisfactory compared with our immediate knowledge of real change (on the assumption that we have such knowledge), still a series of states does seem to be in some way equivalent to real change. But how can any definition be equivalent to an indefinable? The truth seems to be that when we think we are thinking and talking *about* change *in process* we are really only thinking and talking *about completed change*.

In what sense thinking *about* completed change will do instead of thinking *about* change *in process* is a further question which need not be discussed here. Enough has been said to show why Bergson considers the mathematical explanation of change unsatisfactory and why he assumes that change is a process. This assumption is the fundamental point in his theory of change. The objection to Mr. Russell's criticism here was that he never discussed this assumption.

His criticism of duration seems open to a similar charge. Besides the assumption that real change is a process Bergson's notion of duration involves the assumption that there is such a thing as real creation. This assumption, like the other, Mr. Russell passes over in silence. Bergson thinks that all process of change is creative. In fact whenever he has proved that there is process, he seems to think he must necessarily also have proved creation. In this I cannot agree. I can see no logical implication between being a process and being creative. The truth seems to be that Bergson has not realized quite clearly that process and creation are two different things. He speaks of process as if it *meant* creation.

Now, of these two notions the really important one is creation. The question of process alone does not seem to matter very much.

Process of change may not *be* a series of states but it can perfectly well be represented by one. What is really important therefore is to show that some real change, whether it be indivisible or not, is *creative*.

The case here is very similar to that of change. Bergson claims that we have immediate knowledge of creation as well as of change. The act of creation itself, like the process of change is indefinable. All that we can describe is *the created*.

The created may be described by a series of states in which, if any two states be considered, the later will always differ from the earlier just *because* the earlier one preceded it, even though all the other circumstances were the same in the two cases. (This "because" here simply means that their position in the time series is the only circumstance different for the two states, and must therefore be assumed as the ground of their difference.) In the case of such a series you would never get exactly similar repetitions *in the same series*, even if the outward circumstances were exactly similar.

Now, as we have seen, a series of states can only describe *the created* and never the *act of creating*. As in the case of the process of change, so here too mathematicians deny that there is such a thing as the act of creating.

They say that a series of states such as has been described is all that we *mean* by creation. Bergson, on the other hand, asserts that we have immediate knowledge of creation in the case of memory. No answer which ignores this assertion can really touch Bergson's position.

Let us now return to Mr. Russell's criticisms.

Mr. Russell tells us that "Bergson's theory of duration is bound up with his theory of memory. According to this theory things remembered survive in memory, and thus interpenetrate present things: past and present are not mutually external, but are mingled in a unity of consciousness."

Mr. Russell's argument is that the proof of Bergson's theory that in duration the past mingles with the present depends upon his being able to show that such a mingling actually occurs in memory. He then proceeds to show that Bergson's theory that the past mingles with the present in memory rests upon a confusion. In this way he considers that he has refuted Bergson's theory of duration.

Now it is true that Bergson's theory of creation rests upon his

theory of memory. When Bergson says that, in duration, the past mingles with the present, what he really means is that duration is a creative process of change, and to prove this assertion he has first to show that there are such things as process of change and creation, in reality. He claims that we have immediate knowledge of process in any period of consciousness, and of creation as well as process in memory. Memory is the clearest possible instance of creative process that Bergson can find, and, unless such an instance can be found, the theory of duration collapses. If, therefore, Mr. Russell could show that Bergson is wrong in supposing memory to be an instance of a creative process of change, he would have destroyed the best grounds for the theory that in duration the past mingles with the present.

His argument against Bergson's theory of memory is that "when Bergson speaks of the past he does not really mean the past, but our present memory of it," and again, "the real past Bergson simply forgets; what he speaks of is the present idea of the past."

Mr. Russell believes that Bergson's whole theory that in memory the past survives in the present rests upon a failure to distinguish the past from the *idea* of the past. Bergson is supposed to fancy that because our idea of the past is present, therefore the past itself must be present. As it stands this criticism does not really apply to what Bergson means by memory.

To establish his theory of duration what Bergson has to show is that we have knowledge of some instance in which the past mingles with the present in the senses: (*a*) that the past and present are undivided so that they form a process of changing, as opposed to a series of distinct units joined by relations; (*b*) that this past *creates* the present, in the sense that the fact that the present follows just that particular past makes it the sort of present it is.

Bergson holds that introspection gives us this knowledge. He claims that by attending to our own consciousness through a period of its duration we can satisfy ourselves that it forms a process of change. This gives us our instance of a process, and here the question of any present idea of the past does not enter in. Bergson also claims that by attending to the way in which our own character is modified by past experience we can become directly acquainted with an instance of creation. The modification of the present by the force of past experience is what Bergson means by memory, when he uses it to illustrate creation. This need not involve any



conscious ideas at all, so there can be no question here either of confusion of the past with our present ideas of it.

The theory that the past mingles with the present in the sense that past and present form one creative process (which is Bergson's theory of duration) rests then simply on the evidence of introspection. All we are required to do is to attend to the workings of our own consciousness without having recourse to ideas at all. The truth is we are only concerned here with the continuous change of consciousness itself, not even with ideas, and still less with the objective reality about which we have ideas. The only past with which we are concerned is the past of our own consciousness. What is claimed is that this forms one process, continuous with our present consciousness, and *creating* it. Our present idea of the past, therefore, does not come into the question. If Bergson is right in his assertion that we have knowledge of a creative process in our own consciousness, then consciousness has duration. Mr. Russell has not succeeded in showing that Bergson is wrong.

His criticisms of Bergson's efforts to define past and present are more just. Such definitions as "the past is that which acts no longer, and the present is that which is acting" certainly do assume the distinctions which they set out to explain. The truth seems to be that Bergson is so much interested in his discovery that the past acts in the present that he forgets that it is still nevertheless past. And yet that really is the interesting point. It is just because it is the past and not simultaneous with our present consciousness that the fact of its acting on that consciousness is so interesting.

To assume the distinction between past and present as already known, however, is not necessarily to assume *mathematical* time, as Mr. Russell claims. Mathematical time is an infinite series of moments in relations of before and after to each other. The assumption of a distinction between before and after does not necessarily involve a series of this sort. Mere change in quality need not form a series. Supposing pastness were a quality like redness. An event could become gradually more and more past just as a sunset can become more and more red. It is not true therefore that Bergson's condemnation of mathematical time is necessarily contradicted by his attempt to define past and present. Still it must be confessed that the definitions offered are, as they stand, circular and thus worthless.

We may now return to Bergson's identification of subject and object in his account of direct perception.

Mr. Russell maintains that Bergson's theory of perception is due to a failure to distinguish between subject and object in direct perception. He bases his criticism mainly on Bergson's statement that everything we know consists of "images."

What Bergson means by an "image" it is not very easy to define. He says it is "an existence placed half-way between the *thing* and the representation." He certainly does not mean a sensible image, so there is nothing odd in his calling the brain an image, though it has never been imaged.

An image is not the reality of which Bergson claims that we have an immediate knowledge. This knowledge, or experience, is what he calls "intuition." Neither is it a datum of perception, which he considers to be already a mere equivalent symbol which we have made for ourselves. It will be clearest to quote what he says about it himself in his article on "L'intuition philosophique" (*Revue de Métaphysique et de Morale*, Nov. 1911, pp. 810-811). He has been speaking of the intuition of reality from which philosophers start. He holds that all their complicated systems are simply attempts to describe this direct knowledge of what reality is. He now asks:<sup>2</sup> "Quelle est cette intuition? Si le philosophe n'a pas pu en donner la formule, ce n'est pas nous qui y réussirons. Mais ce que nous arriverons à ressaisir et à fixer, c'est une certaine image intermédiaire entre la simplicité de l'intuition concrète et la complexité des abstractions qui la traduisent, image fuyante et évanouissante, qui hante, inaperçue peut-être, l'esprit du philosophe qui le suit comme son ombre à travers les tours et détours de sa pensée, et qui, si elle n'est pas l'intuition même, s'en rapproche beaucoup plus que l'expression conceptuelle nécessairement symbolique, à laquelle l'intuition doit recourir pour fournir des 'explications.'"

It is not really in the "image" at all, therefore, that subject and object are identified—it is in the intuition—the direct knowledge of reality. This intuition is simply our immediate experience. Bergson believes that here the experiencing *is* the reality experienced.

<sup>2</sup> "What is this intuition? If philosophers have not succeeded in finding a definition for it, we are not likely to succeed in finding one. But what we can succeed in capturing and holding before our attention is a certain image, which stands half way between the simplicity of concrete intuition and the complexity of the abstractions which translate it, an elusive image, always on the point of disappearing, which haunts the mind of the philosopher, unknown even to himself perhaps, which follows his mind like its own shadow through the twistings and turnings of thought, and which, if it is not the intuition itself, is much nearer to it than the conceptual expression which is of necessity symbolic, but to which we are forced to resort when we want to supply 'explanations.'"

In the case of our own consciousness as we experience it, before we try to describe it, we do seem to *be* what we experience. I am inclined to think that Bergson believes that it is only our senses and our brains that prevent us from experiencing the whole of reality in the same way, and so *being* it.

This notion is certainly not easy to state but it is equally true that it is no use to criticize it until its meaning has been grasped: there is here no question of a confusion from failure to distinguish, but a deliberate rejection of a distinction fully realized in favor of a single notion held to be more fundamental than the distinction. In any case the confusion, if there were any, would belong to Bergson's notion of intuition. Mr. Russell does not discuss this notion. The question of what Bergson means by "images," which Mr. Russell does discuss, is not really relevant to Bergson's identification of subject and object.

In his last paragraph Mr. Russell accuses Bergson of caring only for action and scorning contemplation. "The good which Bergson hopes to see realized in the world is action for the sake of action. All pure contemplation he calls 'dreaming,' and condemns by a whole series of uncomplimentary epithets: static, Platonic, mathematical, logical, intellectual."

This cannot be allowed to pass. It is too complete a misrepresentation. At the least, Bergson cannot be held answerable to two contradictory charges. It is well known that he denies that the intellect can give us true knowledge of reality because it is preoccupied with action, and selects from reality only such aspects as are useful for furthering action. Since preoccupation with action describe this direct knowledge of what reality is. He now asks: is the ground on which he discredits intellect, it is surely not fair to accuse him of regarding action as the supreme good, and preferring it to contemplation. On the contrary Bergson only criticizes the attempts which the intellect makes at pure contemplation on the ground that even here it is necessarily falsified by being unable to throw off its bias towards action. According to Bergson the intellect developed originally in order to guide our choice of actions by the light of previous experience. It was made to see reality symbolically as made up of things and relations, because only the experience of 'things' which can be recognized as recurring, is useful for this purpose. Even when it turns away from its practical function towards contemplation, Bergson holds that it cannot throw off this predisposition.

Those who seek real contemplation must therefore abandon the intellect. Intellect will never give them wholly disinterested knowledge. This is why Bergson tells us to give up trying to get knowledge of reality by way of conceptual thought, and make instead the great effort which pure intuition demands, not because he despises pure speculation but just because he prizes it so highly.

If the reality which pure intuition reveals should turn out in the end to be mere "activity without purpose" not "inspired by some vision, some imaginative foreshadowing of a world less painful, less unjust, less full of strife than the world of our every-day life . . .," then, doubtless, only those who care more for truth than for a pleasing picture will welcome the new philosophy.

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#### "MULTIPLICATION OF PEARS AND PENCE."

Under the caption, "Multiplication of Pears and Pence," a letter by Mr. Frederic Hovenden is discussed in the October *Monist*, and it is suggested that "some one who believes in algebra" may be found who is willing to defend the use of concrete operators or of concrete numbers in equations.

The fact is that not only are concrete operators and complex units perfectly logical, but in each of the three lines in which arithmetic and algebra are actually used men have come to use concrete operators incessantly, and they *think* in complex units. These three lines are engineering, science and business. Feet per second, ton-miles, cents per yard, watthours, acre-feet, car-miles, pounds per square inch, and a host of other complex units have long ago become single ideas.

Not only physicists and engineers but every one thinks in complex units. 60 mi./hr. is not 60 miles nor 60 hours, but it is 60 *units of velocity*, the unit being a *mile-per-hour*. A railroad hauling 50 tons 200 miles gets paid, not for 50 tons nor yet for 200 miles, but for

$$50 \text{ tons} \times 200 \text{ miles} = 10,000 \text{ ton-miles.}$$

The area of a rectangle  $8 \times 15$  centimeters is

$$8 \text{ cm.} \times 15 \text{ cm.} = 120 \text{ sq. cm.}$$

If we buy 20 pears for 30 d. the cost of pears is

$$30 \text{ d.} \div 20 \text{ pears} = 1.5 \text{ d./pear.}$$

And again note that the cost of pears is not 30, nor 30 d., nor 20, nor 20 pears, nor 1.5, nor 1.5 d., but *it is 1.5 pence-per-pear*.

Says Professor John Perry, "If I were asked to multiply 2 tables by 3 chairs I would not refuse. I would say 6 chair-tables. But if I were asked to say what I mean by a chair-table I would refuse, because nobody has ever given a meaning to the term. But I do know that when this sort of thing comes into a Physical Problem we can always give a useful meaning."<sup>1</sup>

One may also point to the "method of dimensions" so much used in checking formulas, etc. in physics and engineering, by writing out the "dimensions" of the quantities on each side of the equation in terms of length, mass, and time, or the like, to see whether the number of times these quantities appear, is the same on the two sides of the equation. One of the most remarkable points in the history of science is the rôle which dimensions have played in the development of electromagnetic theory. Electric and magnetic quantities may be measured in either of two systems, yet the "dimensional formulas" are not the same in the two systems but have the ratio (length  $\div$  time), which is a velocity. In Maxwell's electro-magnetic theory this velocity is the velocity of light. Experiment has shown this to be true, so that the study of dimensions in equations, that is of concrete multipliers and divisors, has played a most important part in the development of the theory.

To one who has not followed the powerful methods of vector analysis as applied to physics, it is really surprising to learn the extent to which this matter of complex units is carried. Not only does a single symbol represent a very complex unit, but its direction in space is also included in it. Yet the whole complex unit, together with the direction cosines determining its direction in space, becomes a single idea.

From a philosophical standpoint there can be no objection to a complex unit, or to concrete operators, and to one who is accustomed to take a pragmatic attitude of mind, it is decidedly desirable to use them since clearness is surely added by doing so.

Great harm has been done the cause of education by insisting that operators should be abstract.<sup>2</sup> The demand of the pure mathematicians who have written so many of the elementary text-books,

<sup>1</sup> John Perry, *Practical Mathematics*, London, 1899.

<sup>2</sup> For a discussion of the matter from a pedagogical standpoint, see a paper by P. G. Agnew, "Should Concrete Multipliers and Divisors be Allowed?" *Popular Educator*, 28, p. 229, January, 1811.

and the insistence on the part of teachers on set forms of analysis have brought this about. The following example is probably a fair average of the methods actually in use in the schools:

"If  $5\frac{1}{2}$  yards cost 99 cents, the *number* of cents per yard which the cloth costs is the *number* of times  $5\frac{1}{2}$  is contained in 99, or 18."

Who can say that such a benumbing circumlocution makes the matter clearer to the child's mind, (or to an adult mind other than that of a pure mathematician), than merely to say

$$99 \text{ cents} \div 5\frac{1}{2} \text{ yards} = 18 \text{ cents per yard?}$$

The latter presents the whole process of reasoning, both logic and details in a single step.

P. G. AGNEW.

## BOOK REVIEWS.

THE ALCHEMY OF THOUGHT. By L. P. Jacks. New York: Holt, 1911. Pp. 349. Price \$3.00 net.

The *Hibbert Journal* has been before the public for a number of years. It has stood for progress in religion as well as in philosophy, and the latest movements have found an exposition in its columns. Upon the whole one may trace in it the influence of Martineau, the prophet of unitarianism, and also the pragmatism, or indeed pluralism, of Professor James and his adherents. We have now before us a collection of essays written by L. P. Jacks, editor of the *Hibbert Journal*, who at the same time is Dean of Manchester College, Oxford, a dissenter institution. To characterize the tendency of Mr. Jacks we will quote from his preface in his own words:

"To say that the universe is a rational whole appears to me true. But to treat this as an adequate account of reality appears to me false. I am equally averse to regarding the rationality of the universe as the fundamental or all-inclusive or even the dominant form of its self-expression.

"What does form a rational whole and is adequately described by this term is the movement of thought throughout the ages—in a word, the history of philosophy. To equate this movement with the universe to which it refers, to make the history of philosophy into a history of reality, appears to me an error.

"We are constantly tempted to make this equation, and constantly prevented from seeing its falsity, by the habit of treating speculative thought as a form of *ours* into which all experience must manage to fit itself. An important step towards liberation from this habit was taken by Spinoza, who treated thought as one among the infinite and eternal forms of the self-expression of substance—as one and one only. The benefits of this liberty, which relieve the mind from a very great burden, were largely sacrificed in the subsequent developments of Spinoza's doctrine.

"In much that follows I have repeated what is now common among Pluralists."

Mr. Jacks tempers his pluralism by not denying that "the universe does express itself as a rational whole." He only contends that the universe expresses itself in many ways other than rationally. Mr. Jacks continues:

"Pluralism has lost much of the strength it would otherwise have by denying, or seeming to deny, that the universe does express itself in many ways other than those which fit into the forms of conceptual logic. It is certainly true, as the Pluralists contend, that if the universe were nothing but a rational



whole—taking rational in its strict sense—the richness and variety of life would vanish and freedom would be impossible. On the other hand, if the universe were not rational, and were incapable of expressing itself in that form—if, that is, reality were forbidden by its inner constitution from taking that one among all the forms of a possible self-expression—it is equally plain that the world would be no place for beings constituted as we are.

"It will be said, no doubt, that this last statement is itself an appeal to rationality. This rejoinder, common as it has now become, merely serves to remind us once more of the saying that logic is a 'dodge.' As James has pointed out, the word 'rational' is a multidimensional term, and the constant effort of rationalism to confute all critics out of their own mouths appears to succeed only because rationalists expand the meaning of the term 'rational' with every step in the progress of their opponents' argument, and thus make it serve the changing purpose of their own."

Mr. Jacks takes a position which at first sight appears diametrically opposed to our own, for we insist most vigorously on the objective significance of science. We believe that the only philosophy (the word philosophy is here taken in its strictest sense) is "the philosophy of science." There may be innumerable different philosophies in the sense of subjective attitudes, but there is only one "philosophy of science" describing the constitution of the world and of human cognition in objective terms and arguments which are or ought to be as rigid as any of the sciences, as rigid as mathematics so far as they are purely formal, and as objective as chemistry so far as they refer to facts of experience. But while insisting on the objectivity of scientific thought, including the realm which is common to all sciences and forms their foundation, commonly called "philosophy," we not claim that the scientific world-conception is the only aspect. If the constitution of the world were not consistent in itself, reason and rational beings would be impossible, but we insist that the cosmic constitution is in itself consistent and forms an orderly whole from which reason naturally originates so as to suggest the assumption that life everywhere will tend to produce rational beings such as we are. But for all that, the development of reason is only one possible product among many others. This world does not produce rational beings only, it also produces animals, sentient beings, and unconscious organisms such as plants. All these existences are dominated by the law of consistency. Everything can be classified in uniformities, and with the help of the formal sciences we can comprehend all events in history as well as in the processes of nature. Nevertheless the scientific conception of the universe is only one view among several. The artist's view is another, which in its fundamental principle has nothing to do with an intellectual comprehension. The religious view of faith, the mystic dream of the devotee and even of the hazy visionary, the sentimentalist's longing are all as much justified as the scientist's conception. Within the realm of the human soul they are all as real and effective as, yea sometimes more powerful than, the figures of exact science. The writer has always insisted on this variety of view-points and gave an expression of it in his little pamphlet *The Philosophy of Form* as follows:

"A philosopher must not be a one-sided intellectualist. He must bear in mind that the noetic operations of man's mind are only one feature of his life; man is also endowed with sentiment, a sense of beauty, fancy, humor,

and above all he is an actor, a doer, a worker. Man is a struggling creature who must make a living; he is not a mere thinker, his thoughts serve the purpose of lief; they must be applied to the tasks which he has to accomplish in maintaining his existence and earning a livelihood. Philosophy is not mere theory; it serves the practical purpose of teaching us about the world we live in and offers suggestions as to how we are to live and to act. aMn takes delight also in giving expression to his sentiments by depicting in poetry and in art the motives that sway his soul. It would be a serious defect in a philosophy if it attempted to be purely intellectual and ignored religion, literature, the arts and music. The intellectual side is of the utmost significance and quite indispensable for the highest type of man. We must consider that only by his reason has man worked himself out of the brute state. We can never produce a better and a higher age without cultivating a scientific insight, but science is not the goal. It is only the means to the end of lifting humanity to a higher plane. We boldly maintain that a science which does not seek to ennoble the entire man is not the right kind of science. Sentiment must not be neglected any more than the intellectual faculties if we are to bring humanity to its highest and fullest expression."

Pragmatism has an anti-scientific tendency. So far as pragmatism in its positive tenets maintains that there are other view-points possible than that of intellectual comprehension, it is in its way right; but as soon as it denies science itself and would degrade it into a mere subjective attitude which is in constant subjection to reversal, it becomes a reactionary movement which will work as a brake on the wheel of progress wherever it is accepted.

Pragmatism in our opinion has gone too far in denying the objectivity of science and opposing the authority of science in its own realm. Here as well as elsewhere we must render to science that which belongs to science, to sentiment and religion, to art and to mysticism, what is theirs. True enough, science pervades all, and everything can become an object of scientific investigation; but on the other hand even science itself (or perhaps better, scientific aspirations, or the rejoicings in scientific results) may become an object of poetry. In the same way religion as well as art may in their way become as all-pervading as the cosmic order is omnipresent throughout all existence. \*